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Contents

	PAGE
Editorial Notes: A Book for Chemical Engineers and Manufacturers; Exchanging Views with the U.S.A.; Annual Report on Explosives; Co-ordinating Chemical Conferences; The Transport Problem	197
The Calendar	199
The Preparation of Catalysts. By A. A. Pollett, M.Sc. ...	200
Reviews	202
"Text Book of Organic Chemistry" (E. De Barry Barnett); Excess Profits Duty Concessions (W. R. Fairbrother) ...	202
Fulminate of Mercury and Fulminate Mixtures: Notes on Government Experiments	203
Chemical Trade in Holland	205
Cellulose Acetate from the Colloidal Standpoint. By Gustavus J. Esselen	206
Death of Sir Norman Lockyer	208
Chemical and Dyestuff Traders' Policy	209
From Week to Week	210
References to Current Literature...	211
Patent Literature	212
Small Scale Manufacture of Barium Chlorate	215
Market Report and Current Prices	216
Company News	218
Lysle Distributing Agencies	218
Chemical Trade Inquiries	218
Commercial Intelligence	219

Index to Advertisers, see page iii.

NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Other communications relating to advertisements or general matters should be addressed to the Manager.

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A Book for Chemical Engineers and Manufacturers

WE reproduced in our last issue the introductory note to the volume entitled *Preliminary Studies for H.M. Factory, Gretna, and Study for an Installation of Phosgene Manufacture*, recently published by the Ministry of Munitions. Lord Moulton points out in a short foreword to the book that much valuable information has been accumulated at national expense which should not be lost, and that it has been decided to publish as much as possible of the knowledge so gained in order that the nation may profit by it.

Preliminary Studies for H.M. Factory, Gretna, and Study for an Installation of Phosgene Manufacture is the first of the series to be published. In the introduction it is stated that "some of the matter being prepared for publication sets forth the studies and calculations which formed the basis on which a factory was constructed, and are given as examples of an excellent way of treating and presenting the matter." On page 1 it says:—

The following pages give examples of the actual studies which were made for some of the more important sections of the factory at Gretna, and illustrate the method of setting forth the quantities of materials required in different stages of manufacture and the plant necessary for carrying out various operations. Drawings of certain portions of the plant are also given, along with the explanatory notes or descriptions which were issued with each drawing. These descriptive notes were of the greatest help to those erecting the plant and to those who had to run it, by giving a clear understanding of the functions of each part of the plant and the nature of the process to be carried out in it. As full particulars as possible were given on each drawing, so that little time might be lost in understanding it. In some places a few notes in larger type have been inserted to explain the general character of the operations under consideration.

The above gives a clear indication of the scope of the larger part of this volume. We had hoped to be able to give some extracts, but find on more careful examination that it is impracticable to detach advantageously any parts from the whole. The point of interest is the clear presentation of the thorough and systematic way in which, the required output having been decided upon, the quantities of raw material involved and the nature and size of the required plant are calculated. It is pointed out that no doubt the more scientifically directed chemical works have developed excellent methods of dealing with their problems, but their methods and the results of their researches are not available to the public, and the work under review has been written to indicate how some of the technical problems which arose during the war were scientifically studied before operations were undertaken. Numerous excellent working drawings with the copious notes above referred to are given, as well as elaborate flow-sheets of the different processes in the manufacture.

In the second part of the book there is given a separate account of the preliminary studies for an installation of phosgene manufacture. The note to this section states that "the following study of two methods of making phosgene gas and reasons for giving the preference to one, and then developing the quantities of material and the type of plant necessary, should prove particularly helpful and interesting to students and others as illustrating the scientific way in which thermo-chemical and physical data are applied to the solution and development of a technical problem."

On many sides a demand is made for more scientific treatment of our technical problems, and one would hope that chemical engineers, manufacturers and students, in fact all interested in works and plant organisation, may get something helpful from a study of this volume. Indeed, since this valuable information has been made public, it would seem a duty to themselves to make themselves familiar with it. The experience on which it is based is quite exceptional. The work of reducing the results of this experience to order has been done with exemplary thoroughness and

clarity. As a study in principles of method capable of general application it is a document which no one who desires any mastery of the subject can well afford to neglect.

Many records are available of plant results in various manufactures and of experiments on the large scale which should appeal to those in charge of chemical works, and we understand that other volumes are in the press which deal more particularly with specific details of manufacturing processes.

Annual Report on Explosives

THE annual report of H.M. Inspectors of Explosives for the year 1919 bears evidence of the diminution of the industry as the result of peace conditions. The report of the chemical advisers (F. H. and P. V. Dupré) is reproduced elsewhere, and it is largely an account of experiments on fulminate of mercury and fulminate mixtures. The inspectors report a considerable reduction in the number of factories on their books, no fewer than 37 licenses having been surrendered. The majority of these, having been established for war purposes, were closed down as soon as practicable after the armistice, but the recent amalgamation in the explosives trade is also partly responsible for the reduction. As 73 new factories were licensed during the war a considerable number of licenses are expected to be surrendered during the current year. The number of accidents in manufacture was 65, causing eight deaths, and injuries to 31 persons. Six of the deaths occurred during the breaking up of ammunition, emphasising the warning previously given that unmaking explosives is more dangerous than making them. The total number of accidents from all causes reported during the year was 430, causing 58 deaths and injuries to 502 persons. This number not only shows the decrease to be expected during the first complete year since the cessation of hostilities, but brings us back to pre-war conditions, being in fact the smallest number reported since 1908, while the number of deaths recorded is the smallest since 1912.

The most satisfactory feature, the report states, is the great decrease both in the total number of accidents and in the number of persons killed and injured which has occurred in manufacture, under conditions to which the Act applies. There has, however, been an increase in the number of accidents causing death or personal injury which have occurred during the use of explosives or under miscellaneous conditions to which the provisions of the Act do not apply. These accidents amount to over 91 per cent. of the total and caused 48 out of the 58 deaths and 469 out of the 502 cases of injury. The total number of accidents in manufacture, keeping, and conveyance, the conditions to which the Act does apply, was 70, causing 10 deaths and injuries to 33 persons, and of these 70 accidents 36 were unattended by personal injury, while of the 360 accidents in use, &c., only three were reported which did not cause injury. While this is no doubt partly due to the fact that an accident in use, not causing injury, would very rarely be reported, whereas the slightest case of fire or explosion which may occur in a licensed factory must be notified at once, it is only reasonable to assume that the numerous precautions adopted to minimise the risk of injury in case of accident during manufacture must be credited with a considerable share in this satisfactory result. This is borne out by a study of the accidents during the manufacture of the smaller articles, such as detonators, and also in the case of explosions in gunpowder incorporating mills.

As to the causes of accidents one is attributed to defects in electric lighting, and the inspectors recommend that with a building such as a corning house the wiring should not be carried on the building but should be in properly earthed conduit pipes attached to standards outside the windows. Two accidents were due to sparks igniting clothing impregnated with powder dust, and another was caused by the spontaneous ignition of peat charcoal, with which experiments were being carried out in a " pebble " cutting machine During the year a series of experiments at the Rotherham testing station was begun, using natural methane obtained from the Cymmer Pit, Glamorgan, instead of coal gas. These are being continued in connection with the handling or transport of petroleum. The inspectors mention the difficulty of obtaining a really gas-proof joint when petroleum vapour is in question, the need of testing for vapour all spaces before repairing a vessel in which oil or spirit has been carried, and the danger from drums or tanks which have been emptied of petroleum spirit. No fresh legislation has to be recorded in connection with carbide of calcium.

Exchanging Views with the U.S.A.

THE need of preserving a good understanding between this country and the United States of America is just now of the first importance, and friendly exchanges of opinion which tend to interpret the one nation to the other are one important means of securing this end. Recently we are glad to notice the appearance in the leading American chemical journals of periodical letters from London correspondents, and our interest in this development is none the less because THE CHEMICAL AGE has supplied several of the writers. *Chemical & Metallurgical Engineering* has for some time been publishing contributions on British chemical and metallurgical developments from two members of our editorial staff, and now *The Journal of Industrial & Engineering Chemistry*, the official organ of the American Chemical Society, has begun a London letter by Dr. Stephen Miall, another valued occasional contributor to THE CHEMICAL AGE. Nothing but good can come of these efforts on the part of responsible writers to keep the United States informed of the progress of chemical science and industry in this country. It may, indeed, become the function of our scientists and scholars, representing interests which transcend national and racial limitations, to make up for the blunders of our politicians by emphasising the unity of aim and interest which appeal equally to the best elements in all nations.

In one paragraph headed " A Period of Chaos," Dr. Miall states so frankly the industrial troubles confronting us in this country, that it may be interesting to reproduce it :—

In applied chemistry we are faced in Great Britain with a state of uncertainty and chaos without parallel in the recollection of any of us. No one can form any just estimate of the

future supply or price of coal or other fuels; no one has any sure data upon which to base an opinion as to the future of the principal metals and other raw materials. Accounts from Germany and Austria are singularly conflicting and it is not easy for us to know whether in chemical industry we are to export to those countries at a reasonable profit or whether we shall suffer from acute competition from those countries. And in our own financial state nothing seems certain beyond the fact that grievous and necessary taxation will continue for a long period and will hamper the development of business and the starting of new enterprises. We have recently lived through times infinitely more anxious, and our neighbours in France and Italy have far more difficult problems to solve than we have. Our anxieties are as nothing to theirs and the state of political, industrial and financial chaos in Germany, Austria and Russia is such as to be beyond conception. We are not merely perplexed by this; the aspect continually changes and it is hopeless for us to try and imagine what will happen in the east of Europe. In time some sort of settlement or stability will be achieved, but the details of the process are beyond the wit of man to imagine.

Co-ordinating Chemical Conferences

AN excellent suggestion for the co-ordination of the chemical conferences to meet in the United States in the autumn of next year is made by Dr. Herty, editor of *The Journal of Industrial and Engineering Chemistry*, and supported by Mr. H. C. Parmelee, editor of *Chemical and Metallurgical Engineering*—two good friends, by the way, of this country. Dr. Herty was unable last year to include London in his visit to Europe in connection with the dye situation, but those who know him will not need to be reminded of his desire to bring the chemical interests of the world into close and effective union. Mr. Parmelee visited this country during the war with a party of distinguished American trade and technical journalists, and he returned impressed not only by the magnitude of our war efforts but by the sympathy between British and American ideas.

The occasion to which they refer is certainly one that provides a rare opportunity for international intercourse between chemists. Four events are scheduled in which chemists generally are keenly interested, and the suggestion is that they should be so arranged as to enable those interested to attend all of them. In addition to the visit of the Society of Chemical Industry, the Canadian Institute of Chemistry, the American Chemical Society, and the National Exposition of Chemical Industries will hold their customary conventions. In order to enable visitors to one or two of these to cover the entire four it is proposed that all the organisations should co-ordinate their plans so that the meetings fall within two weeks. This would allow the meetings of the three chemical societies to be attended and an inspection made of the exhibits. More than this, as our American friends point out, it would provide an opportunity to establish closer professional relations between British, Canadian and American chemists, and to strengthen Anglo-Saxon as well as professional bonds.

"Subsequent to the war," Mr. Parmelee writes, "there was much talk touching on the probable Anglo-Saxon supremacy in world affairs. To such a prospect we have always given hearty assent and have welcomed every opportunity to promote its accomplishment. Consequently, in this group of chemical conventions we see an opportunity to forward Anglo-Saxon unity and solidarity as well as chemical knowledge. The Chemical Exposition being a fixed festival, it would seem appropriate for its promoters to take the initiative in an attempt to realise this very delightful prospect." We are sure that these aims will command the sympathy of the Society of Chemical Industry, and that the Council will wish to co-operate with those of the Canadian and United States organisations in bringing about so memorable a combined gathering.

The Transport Problem

THE transport problem, already sufficiently troublesome to all engaged in distribution, becomes more than ever serious in view of the increase of tolls, rates, and charges now officially announced. It might be some compensation if we knew that the increase of 100 per cent., plus flat rates of anything from 6d. to 2s. a ton, would result in a corresponding improvement in the handling of stuff, but nobody is optimistic enough to expect anything of the kind, and the commercial community will have to find room for this new tax somewhere in their charges or curtail business or develop other means of transport. The third course will, no doubt, receive attention, but here again the high cost of motor spirit may neutralise some of the advantages offered by independent road transport. For the moment there is nothing to do but pay—with increasing discontent at the charges and at the indifferent service.

The schedules published this week set out in detail the increases in the rates. Coal, coke and patent fuel are subject to an advance of 100 per cent., plus a flat rate of 6d. per ton, and the same rate applies to most of the general merchandise classes. Among the modifications we notice that manure in bulk, packed manure, basic slag and lime, conveyed by merchandise train in minimum loads of 2 tons for use as agricultural manure, are subject to an addition of 50 per cent. In addition to the heavy increase in the cost of carriage the rent of trucks used by traders is put up 100 per cent., with a minimum charge of 9d. per ton. At a rough estimate, we should say that our transport authorities have managed to put on the last ounce that trade can bear; it remains to be seen, indeed, whether, with all the other burdens, it can stand the strain.

The Calendar

August 24–28	British Association	Cardiff.
Sept. 1	Institution of Petroleum Technologists: Oil Prospecting," by G. Howell. 6 p.m.	Canada Buildings, Crystal Palace, London.
15–16	The Institute of Metals: Autumn Meeting.	Barrow-in-Furness.
21–24	Iron and Steel Institute: General Meeting.	Cardiff.
Oct. 1	Society of Chemical Industry (Manchester Section): "The Structure of the Molecule in Crystalline Solids," by Professor W. L. Bragg.	Grand Hotel, Manchester.
9	Mining Institute of Scotland: General Meeting.	Edinburgh.
18	Physical Society of London and Faraday Society (Joint Meeting): "The Physics and Chemistry of Colloids."	London.

The Preparation of Catalysts

By A. A. Pollitt, M.Sc.

In the following article the writer has collected together some useful information in connection with the preparation of modern catalysts. He also touches upon the subject of colloidal catalysts, and the means whereby the necessary stability is obtained by the employment of protective colloids.

THE development of the practical application of catalysis may be said to date from the discovery in 1899 of Sabatier and Senderens, who observed the activating effect of nickel on the activity of hydrogen. For a few years previous to this date, isolated cases were recorded by a few investigators who had been successful in reducing, by means of platinum and palladium black, such compounds as acetylene and nitro-benzene, &c. Probably the first commercial application of catalysis was the hydrogenation of unsaturated glycerides; and, during the 20 years of its development, catalytic processes have facilitated the preparation of many organic derivatives—both open-chain and aromatic compounds, as well as substances of a highly complex character, such as reduced alkaloids. The stereotyped example of the activating effect of a catalyst on free hydrogen is the reduction of oleic acid to stearic acid. In the absence of a catalyst, oleic acid is scarcely, if at all, affected by nascent hydrogen; but if a suitable catalyst be present it is both readily and quantitatively reduced to stearic acid. Before discussing the preparation of catalysts, it may be mentioned that, in addition to the direct introduction of hydrogen, catalytic reduction can also be applied to the conversion of such groups at CO and CH . OH to CH_2 and CH_3 respectively, and also of metallic oxides to metal.

Metallic Catalysts

The metallic catalysts may be conveniently divided into two groups:—

1. Iron, nickel, cobalt, copper.
2. Platinum, palladium, osmium, iridium, ruthenium, rhodium.

The first group, as a rule, exerts a marked catalytic effect only at elevated temperatures, whilst those of the second group are all active at ordinary temperatures. For each catalyst there is a minimum temperature at which activity begins to develop, and from this point the activity increases to a maximum value, corresponding to a definite temperature, depending on the metal and on the reaction in progress. Beyond this "optimum" temperature the activity decreases. From the point of view of ascending order of minimum activating temperature, the first group may be written nickel, cobalt, copper, iron, and the order of their activity may be taken to vary in the same direction. Thus, nickel has the lowest minimum activating temperature, and is the most active catalyst of the group. Of the second group, platinum and palladium are by far the most extensively used and osmium is the least active.

The Nickel Group

In preparing a catalyst, the following points are those which require chief attention:—

1. The purity of the materials used. An estimate of this should be based on the absence of catalyst poisons rather than on the usual chemical standards of purity. In many cases the presence of a non-poisonous impurity may have no detrimental effect, but may even be beneficial, whilst the presence of very small quantities of arsenic or sulphur would decrease the activity of the catalyst to a serious extent.

2. The maximum temperature to which the metallic oxide or salt is exposed during the production of the catalyst. The temperature of reduction influences very considerably the nature of the resulting catalyst. The lower the temperature at which the oxide or salt is reduced the greater will be the activity, although the employment of a reduction temperature below that at which the catalytic process is to be carried out may mean a longer time taken to produce the catalyst, without ultimate gain in activity. Reduction at a comparatively high temperature, whilst yielding a less energetic catalyst, usually imparts a higher power of resistance to the action of anti-catalysts, or poisons.

3. The proposed method of employing the catalyst.

If hydrogenation is to be carried out by the vapour method, it is necessary to support the catalyst in such a manner that it presents a large active surface, and at the same time offers as little obstruction as possible to the passage of the gases or vapour through the reaction chamber. In cases of this kind the use of asbestos rope, pumice or other inert material may be employed. The material is thoroughly cleaned with dilute nitric acid and then ignited. It is then soaked in, for example, nickel nitrate which has been melted in its own water of crystallisation, or in a concentrated solution of the salt, and heated to the minimum temperature necessary to convert the nitrate to oxide. The supports carrying the oxide are placed in position in the reaction chamber, and are there reduced by pure hydrogen immediately before it is desired to commence the hydrogenation. As an alternative to this procedure, the asbestos or pumice supporting the nickel nitrate may be treated with a solution of caustic soda or alkali carbonate, and then thoroughly washed with distilled water, and the catalyst then produced as in the above method. Porous briquettes may be substituted as the support for the catalyst. The following description illustrates one method of preparing such briquettes: To a solution of nickel nitrate there is added a solution of magnesium nitrate in such quantity that subsequent treatment with soda will give a weight of magnesium oxide equal to the weight of the nickel in the nickel nitrate. After precipitation of the solution with soda or carbonate, the precipitate is washed with distilled water and is spread in a thin layer on a clean nickel plate, divided up into squares or rectangles of a suitable size with a bone spatula, and then dried by the cautious application of heat.

Suspended Catalysts

For the reduction of liquid compounds or of substances in solution, the catalyst is generally used in the form of a suspension, being removed from the liquid at the end of the operation either by filtration or other more suitable process. To prepare a nickel catalyst for use in this manner, pure nickel oxide or carbonate, made by precipitation from a solution of the nitrate, is reduced by pure hydrogen at a temperature of 300°C. to 320°C. The less expensive nickel sulphate (if prepared by the Mond carbonyl process) may be used in many cases in place of the nitrate, and gives almost as active a catalyst, although the sulphate contains a catalyst poison. The nitrate may also be directly converted to oxide by heating at the lowest possible temperature, instead of precipitating the solution with alkali.

In certain cases it is possible to reduce the oxide to metal in the liquid that is to be hydrogenated. For instance, where non-volatile liquids boiling at temperatures above that necessary for the reduction of the oxide are concerned, there is no risk of the liquid decomposing during the final stage of the preparation of the catalyst, and hydrogenation may subsequently be effected by the bubbling method. In a liquid medium, the reduction of oxide or salt to nickel may often be accomplished at temperatures considerably

below that required for reduction in the dry condition (*i.e.*, 300°C). Thus, a temperature of 255°C. may be sufficient in a particular case, and 280°C. may be regarded as a maximum under such conditions. It is preferable, if the nickel oxide is reduced in the dry state, that this be effected immediately before use, and that the catalyst be allowed to cool in the current of hydrogen before the liquid to be treated is introduced. Kieselguhr or carbon may be mixed with the nitrate (or sulphate) solution in proportions varying from two to ten parts to one of metallic nickel, in order to increase the catalytic surface exposed. The precipitation of the carbonate or oxide is, in such a case, effected during constant agitation or stirring.

The other catalysts of the first group are used far less extensively than nickel, and are, in consequence, of less importance. Copper is used chiefly in reactions which do not require so active a catalyst as nickel. Iron and cobalt are used even less than copper. Cobalt is intermediate between copper and nickel in activity; and iron is, at its best, only slightly active, and is for many reactions quite inactive. The minimum temperature at which it first assumes activity is far higher than for the other metals. The methods given for the preparation of catalytic nickel apply also to the production of iron, cobalt and copper catalysts. The reduction temperature for copper is a little under 200°C. Iron is obtained from the oxide or carbonate at 450°C. to 500°C., and cobalt at about 400°C. to 450°C. The methods of preparation discussed so far all involve the reduction of an oxide at moderate temperatures by hydrogen. The production of nickel catalyst by the decomposition of nickel carbonyl has been proposed; and the lactate, formate and other organic nickel salts may be substituted for the oxide and yield catalysts of high activity.

The Platinum Group

The members of this group are principally used in the hydrogenation of liquids, and solutions at the ordinary temperature or at temperatures but little in excess of this. The state of division of the catalyst is of vital importance in determining the velocity of the reaction; for this reason the introduction of colloidal catalysts has made possible many hydrogenations which would be unattainable with less finely divided catalysts, which act slowly and are very easily killed by poisons. It is easy to reduce salts of platinum and palladium, &c., by means of hydrogen, formaldehyde and other organic agents; but the metal is, in most cases, produced in a flocculent condition, and has the disadvantage of presenting a relatively small surface. A non-colloidal catalyst sufficiently active for certain reactions, may be obtained by suspending platinum chloride in the liquid to be reduced, and passing free hydrogen at 100°C., or even less, enough sodium carbonate being added to neutralise the hydrochloric acid produced. Thus, in the case of an unsaturated glyceride, rapid hydrogenation is effected by this method even when the amount of catalyst present is only about 0·1 per cent.

The metals of the platinum group have been obtained in a colloidal condition, and in very dilute solution, by a number of investigators by reducing solutions of platinic chloride with formaldehyde, hydrazine hydrate, gallic acid, tannin, &c. These dilute solutions are very easily coagulated by electrolytes, and are, therefore, of little use for practical catalytic hydrogenation.

Protective Colloids

In order to secure the necessary stability, protective colloids are employed. Paal and Amberger (Ber., 1904, 35, 124) make use of sodium lysalbate or protalbate for this purpose. These are two products derived from egg-albumin by treatment with alkalis. The following example illustrates the preparation of "protected" colloidal platinum: Two grammes of platinic chloride are dissolved in a little water. A second solution is prepared containing 1 gramme of sodium lysalbate in 30 cc. of water, to which is added a slight excess of caustic soda over that required to react with the chlorine of the platinic chloride. The platinum solution is added to this alkaline solution, and reduction is then effected by a slight excess of hydrazine hydrate. The colloidal platinum is purified by dialysis, and, after first evaporating on a water bath and then in vacuo, the colloidal metal is obtained in the form of black plates, readily soluble in water, giving a black and opaque solution. Colloidal palladium is prepared in a similar manner, and sodium protalbate may be used in place of the lysalbate. Hydrazine is generally recognised as the most suitable reducing agent for platinum and palladium, though gaseous hydrogen has been used. Hydroxylamine and formaldehyde are not suitable. Nacent hydrogen obtained from sodium amalgam is sometimes used in preparing colloidal iridium.

Palladium produced by the above method is not suitable for hydrogenation in acid media, since under such conditions an adsorption compound of protalbic acid and palladium is precipitated. To overcome this difficulty, the palladium is protected by a colloid which is stable in contact with acids. For this purpose the colloid obtained by the action of an organic acid on gluten has been recommended. (Ber., 1912, 45, 1946.) A protective colloid solution is prepared by treating gluten with acetic acid, and to 30 grammes of this solution, containing about 50 per cent. of the treated gluten, is added a solution of 8 grammes of palladium chloride in a small amount of water. To the brown solution so obtained a little ammonia is added, followed by hydrazine hydrate, drop by drop, until frothing and the evolution of gas ceases. The colloidal palladium is then dialysed until the outside water is free from chloride, and is finally evaporated and dried in vacuo, when it appears as black, glittering scales.

Colloidal Platinum

The simplest method of obtaining colloidal platinum or palladium is by inoculation, for which a small quantity of the colloidal metal is required. Equal parts of the metallic chloride and gum arabic are dissolved in water, and a trace of the colloidal metal (previously prepared by any suitable method) is added. On reducing the solution by hydrogen most of the metal is rendered colloidal, and may be isolated in the usual manner by dialysis, &c.

In conclusion, it may be mentioned that, instead of introducing the metal in the metallic form into the substance to be treated catalytically, an oxide or salt may sometimes be conveniently substituted. In such cases it is, of course, obvious that conditions must be such that a sufficient amount of reduction of the oxide or salt is effected by the hydrogen. Thus, platinic chloride, nickel oxide, or nickel formate, &c., may be used in place of platinum black and metallic nickel. In the majority of reactions it is imperative that anti-catalysts, such as sulphur, phosphorus, arsenic, lead and their compounds should be absent. In one or two cases, however, the catalyst may contain an appreciable amount of sulphur as sulphate or sulphide without any detrimental effect. Another form of poisoning is sometimes met with in reactions in liquid media where colloidal or other impurities settle on the catalyst and retard its action. This effect has also been observed in gaseous reactions.

It is announced that, provided sufficient merit be shown, an election to a FELLOWSHIP IN EXPERIMENTAL PHYSICS OR PHYSICAL CHEMISTRY at Trinity College, Dublin, will take place in May, 1921. Candidates must submit papers or theses (published or unpublished) on or before March 25 next. Further particulars may be obtained from the Registrar, Trinity College, Dublin.

Reviews

"An Introduction to Chemical Engineering." A. F. Allen. Pp. xvi., 272. Sir Isaac Pitman & Sons, Ltd., London. 10s. 6d. net.

Since Davis gave us his classic treatise this subject has been sorely neglected, though Hinchley's booklet on Chemical Engineering would probably have been followed by others dealing with the remainder of the subject had not the war and other circumstances intervened. The present volume is, therefore, welcome, and its object is stated in the publisher's note "to serve as an introduction to chemical engineering by familiarising the student with those types of machines which are in general use in the chemical industry. The plan is to take the various pieces of apparatus in common use in chemical laboratories and describe their industrial counterparts. In this way, the reader's already fair knowledge of the theory of chemical engineering is broughtinto union with modern practice."

At first it is difficult to judge of its particular place in what should be a well-considered general educational scheme. While hardly a real text-book for the use of students, it can be read with profit before leaving college. The qualified chemical engineer will learn little from it that he does not or should not know already, though it might serve as a useful digest of manufacturers' catalogues and technical data. On the other hand, it should prove very useful to non-technical directors, works chemists and managers, who have to purchase or supervise plant without necessarily dealing with details of design and operation.

The book is well illustrated and very readable. The scale of drawings or other means of indicating the size of the apparatus shown would be an improvement. The scope of the book is necessarily limited, but notable omissions are references to rotary filters, Pfleiderer mixers, Dorr thickeners, Gee and Sturgeon centrifugal filters. The notes on disintegrators, evaporators and temperature control, and parts of the appendix are useful. but to include a description of suction gas plant under distilling apparatus seems unnecessary.

It is no secret that other works on chemical engineering are in preparation, and it is hoped that some attempt will be made to prevent overlapping. It is impossible for one man to write a complete treatise to-day on a subject which is becoming more and more specialised, and it seems well within the province of an educational body like the Chemical Engineering Group of the Society of Chemical Industry to endeavour to regulate and co-ordinate the output of literature on this increasingly important subject. C. J. G.

Experimental Researches and Reports. (Vol. 2.) Published by the Department of Glass Technology, Sheffield.

These researches and reports are a collection of pamphlets read at the Sheffield meetings or contributed to the *Journal of Glass Technology*. They deal in the main with work carried out on various points in connection with the glass industry, and on the whole represent a year's progress in glass research under the auspices of the Glass Research Delegacy.

The most interesting feature of the collection is a series of papers on the lime-soda glasses, 3, 6, 7, 8 and 10. The two on the magnesia-soda glasses, 12 and 13, are interesting for the purposes of comparison. In the work on the lime-soda glasses 17 different compositions were used, the ordinary white-flint glass occupying the midway position. It is an interesting result that when the annealing temperatures are plotted against the molecular content of lime (CaO) as calculated from the results of analysis, a smooth curve is obtained which rises rather steeply.

Paper 4 is the result of analysis of two types of American glass. The paper shows clearly the successive steps in such an analysis on the lines described by Caudwood and Turner in the *J. Ind. Eng. Chem.*, 1917, 9, 1,090.

Paper 7 is well worth study by workmen and those engaged on the practical side of glass making. The tests by water and steam, acids and alkalies, are described, and since the batch compositions are also given the results should be perfectly plain to those who have no great technical knowledge. With constant study of this kind we should soon be able to disperse some of the difficulties under which British glass manufacturers are labouring at the present time, and such work deserves the best aid that manufacturers can give it.

"Text Book of Organic Chemistry"

To the Editor of The Chemical Age

Sir,—My attention has been drawn to a review of my "Text-Book of Organic Chemistry" which appeared in a recent issue of The Chemical Age. In this review adverse criticisms are made, and are supported by quotations from the text which almost seem to be deliberately shorn of the context so as to produce a false impression. For example, your reviewer states "on pages 64 and 76 we learn that 'alcohols in which two or more hydroxyl groups are attached to the same carbon atom are so unstable that they are incapable of existing.' The student would therefore be surprised to find on page 93 that such compounds are exceptional . . . ." Reference to my book will show that on page 64 it is distinctly stated that some compounds are known in which two carbroxyl groups are attached to the same carbon atom, and dihydroxytartaric acid is actually given as an example. Again, your reviewer criticises my statement on page 365 with reference to the mydriatic action of alkaloids; but my statement, when taken with the context, obviously refers to the alkaloids actually mentioned by name—viz., atropine, hyscine and hysocyamine.

From the above instances your readers will be able to form their own opinion of the value of the rest of the review.—I am, &c.,

E. de Barry Barnett.

Excess Profits Duty Concessions

To the Editor of The Chemical Age

Sir,—The Finance Act, 1920, having now reached its final stage, will prove of great interest to those liable now or previously to Excess Profits Duty. It is well known that the duty has been increased to 60 per cent. from January 1, 1920, but it is not so well known how the various alterations will affect the amount of duty payable or recoverable. The concessions fall into certain groups as under:—

1. Ex-service men are to have an increase of the statutory allowance from £200 to £500 in certain circumstances.

2. A new pre-war standard (called "the substituted standard") is introduced, under which the "small" and "new" men have the choice of an amount to £500 for each working proprietor. In addition, in the case of the new business, a percentage is given on the capital in the first period, whilst in the other cases the usual percentage standard is allowed. The substituted standard must not exceed a total of £750 for each working proprietor. The substituted standard can be claimed in certain circumstances on behalf of the widow of an ex-service man.

3. Any trade or business of a company whose directors have a controlling interest is for all purposes of statutory percentage to be treated as a firm.

4. The percentage is increased to 11 per cent. in the case of companies and 13 per cent. in all other cases, for the purposes of increased capital allowance and of statutory percentage in "new" businesses.

5. The additional allowance granted in the case of "small" businesses is now applied where the pre-war standard does not exceed £2,000 and the profits of the year are less than £4,000. This extended allowance cannot, however, be claimed when the substituted standard has been adopted.

6. Charitable contributions not exceeding 5 per cent. of the profits and up to 20 per cent. of such contributions are allowed as a deduction.

The foregoing broadly covers the effect of the new changes, but obviously it is impossible to compress into a letter the many detailed interpretations, provisos, &c., contained in the Act, which requires careful study fully and thoroughly to grasp its provisions.—Yours, &c.,

67-68, Cheapside, London, E.C.2. W. R. Fairbrother.

Mr. G. T. Milne, O.B.E., Commercial Secretary to H.M. Legation at Havana, Cuba, has received from a local wholesale druggist an inquiry for the names of British manufacturers of hat gelatine, which he claims to sell monthly to the value of $8,000, imported wholly from the United States. United Kingdom firms interested may obtain particulars of the firm on application to the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

Fulminate of Mercury and Fulminate Mixtures.

Some Notes on Government Experiments

In the report of the chemical advisers under the Explosives Act, 1875, attention is drawn to the work done during the past few years on fulminate of mercury and fulminate mixtures. The authors (F. H. and P. V. Dupre) explain that only a short summary of the work is possible and also that a great part of it was of such a nature as to make publication impossible. They do not claim that all the results given are original, but there was a great difference of opinion about them. In the extracts below they give a number of experimental results, selected from a very large amount of work, to show fairly well the grounds of their contentions.

THE total number of samples examined during the year amounted to 349, or practically the same as last year. Under present conditions this will, no doubt, be a normal figure. The number of unsatisfactory samples (57) is fairly normal, especially considering that the proportion of permitted explosives is steadily increasing. A large number of these samples contained an excessive quantity of moisture and this was very noticeable in the case of gelignites and gelatine dynamites containing sodium nitrate. The number of testing station samples is also very low, as is also the number of new explosives examined.

Sensitiveness of Fulminate of Mercury to Direct Percussion

We found the most extraordinary differences in the sensitiveness of fulminate of mercury, not only from different makers, but even in one sample. The sensitiveness was taken by putting the thinnest layer that we could keep continuous on to a steel anvil, covering it with a hard steel cylinder ¼ in. diameter and ¼ in. high, and dropping a ½ oz. weight (in most cases) on to the top of the cylinder from an electromagnet. A point was found at which six consecutive drops failed to produce an explosion, different portions of fulminate being used for each drop, while, on raising the height through which the ball dropped by 2 in., at least one out of six caused an explosion. Owing to the small weight of the ball we used this measure was a very accurate one, the difference in the strengths of the blows that caused or failed to cause explosion being only 1/192 ft. pound.

On one occasion we examined seven samples and found that the height the ½ oz. ball had to fall to cause detonation varied from 12 in. to 22 in., while the same samples, when ground, failed to explode when struck by a 2 oz. ball falling from a height of 46 in.

A careful microscopical examination of these samples failed to show any difference in the crystalline structure, except that the sensitive samples contained much larger crystals and a much smaller proportion of broken-up crystals.

Following these experiments a very large number of tests were carried out, and it was found that the sensitiveness depended almost, if not quite, entirely on the size of the crystal. The following additional results will prove this :—

(*a*) A sample of fulminate was passed through a series of sieves and each portion tested for sensitiveness. It was found that the sensitiveness fell regularly as the size of the mesh of the sieve was reduced.

(*b*) Two samples of fulminate were selected, one being very sensitive to shock, one very insensitive. Both were crushed to a very fine powder and retested for sensitiveness, when they were found to give the same results.

(*c*) Several tests were made on that portion of a sample of fulminate which passed through a 200-mesh sieve, and all gave practically the same figure. These results were confirmed on a large number of occasions, and it is therefore worth pointing out that the original sensitiveness of the fulminate has little or no influence on the sensitiveness of the finished detonator. The pressure applied to the detonators is sufficient to reduce the fulminate to a very fine powder, in which condition all of a very large number of samples examined gave approximately the same figures for sensitiveness.

Influence of Foreign Matter on Sensitiveness

A certain amount of foreign matter is always present in fulminate and is discovered when large quantities are sieved before drying. The question arose whether this foreign matter was a source of danger during handling and pressing of the dry fulminate. The amount of solid foreign matter present in well-manufactured fulminate is extremely small, somewhere in the region of 0·01 per cent., and of this a good deal, consisting of fibres, &c., will not pass through the 80-mesh sieve generally used. We collected from the sieve some of this foreign matter from two different makes of fulminate, added comparatively large proportions to pure fulminate and tested the mixture for sensitiveness. In one case the sensitiveness was actually reduced, in the other slightly increased, but not to such an extent as to make the fulminate unduly dangerous to handle. Its effects, therefore, when distributed through the bulk of the fulminate, as it is normally, is quite negligible. The bulk of the solid matter is organic, and is probably derived from the wooden and rubber bungs which have been acted on by nitric acid.

Sensitiveness of Moist Fulminate and Chlorate Mixtures

A very curious instance came under our notice in the case of a factory where large quantities of moist fulminate and chlorate mixture containing 2 per cent. of moisture were being used, the management being under the impression that such mixture was wet enough to be quite safe to handle. We found on experiment that mixtures containing up to 5 per cent. of moisture were actually rather more sensitive to direct percussion than the dry mixture, while to combined percussion and friction they were very slightly less sensitive.

Sensitiveness of Fulminate and Chlorate Mixtures

The sensitiveness of these mixtures to percussion when the chlorate of potassium has been passed through a 120-mesh sieve is very much less than that of the fulminate from which it is made. It is, however, much more sensitive to friction.

Sensitiveness of Fulminate Chlorate and Sulphide Mixtures (6.6.4.)

The sensitiveness to direct blow of these mixtures when the potassium chlorate and sulphide of antimony have been passed through a sieve with 120 meshes to the inch (I.M.M. Standard) is practically the same as that of the fulminate from which it is made. It is, however, vastly more sensitive to a glancing blow than pure fulminate and some trouble has been caused when all three ingredients were very fine, by portions of the mixture getting between the sliding parts of the filling machines. We especially found it desirable to avoid having too much very fine powder in the sulphide of antimony, but accurate grading of this material is practically impossible, besides causing a serious loss of material. We also found that if all the fine powder were excluded further troubles during mixing were met with. We got very satisfactory results when using a sulphide, all of which passed through a standard sieve with 120 meshes to the inch, while not less than 20 per cent. was retained on a sieve with 200 meshes to the inch.

We made no attempt to grade the chlorate used, and most of it was extremely finely powdered, but as we met with no trouble in its use we did not carry out any experiments to see whether any advantage would have been secured by excluding the finest portions. Here again accurate grading is very difficult, and unless it can be shown by experiment that very substantial advantages are obtained by excluding the finest portions the loss involved in grading would not be justified.

When the chlorate and sulphide have been passed through a sieve with 120 meshes to the inch further variations in the size of the particles have very little influence on the sensitiveness of the mixture, unless all three ingredients are very fine, when the sensitiveness is very much reduced. The sensitiveness of the mixture depends on that of the fulminate used. Thus, if a number of tests of sensitiveness of 6.6.4 mixture are made on different portions of a mixture considerable variations will be found, but the whole range will be covered if the fulminate used be tested alone. Further, if 6.6.4 mixtures are crushed and then tested for sensitiveness they all give approximately the same figure for sensitiveness quite independently of the source or sensitiveness of the fulminate used.

The following table gives the blow in foot pounds per square inch required to cause detonation and gives typical results obtained from fulminate and these mixtures, and similar results have been obtained on a large number of occasions.

Various 6.6.4 mixtures.	Three samples of Fulminate.	Different portions One bag of Fulminate.	6.6.4 mixtures al with same samples of Chlorate and Sulphide.
1·90	1·57	1·34	1·57
1·90	1·90	1·90	2·06
1·72	2·22	1·90	1·57
2·06		2·06	1·34
1·72			1·72
1·72			1·90
1·72			
1·90			
1·90			
1·72			
1·90			
1·72			

A ½ oz. sample of 6.6.4 mixture was put into a tube in which it occupied 1 in.

Top portion	1·90
Middle portion	3·24
Bottom portion	2·54

From the aboye it is clear that the sensitiveness of the mixture is determined by the fulminate.

The fact that the mixture has practically a constant sensitiveness after crushing is of importance, as it shows that the original sentiveness of the fulminate is of no consequence as far as the sensitiveness of the finished detonator is concerned. A fulminate with a fair-sized crystal and without too large a proportion of fine powder runs much better, or, when mixed with chlorate and sulphide, forms a much better running mixture than does one with very small crystals, and is therefore more easily dealt with by the mixing and filling machines. Provided that an undue proportion of press explosions are not caused, the larger the crystals used the better.

A further disadvantage in the use of very fine fulminate has already been pointed out, viz., that the very fine mixture gets into parts of the filling machines where the coarser mixtures cannot enter, and its presence there involves risk of accident.

With regard to the influence of grit on the sensitiveness of the mixture, quantities up to ½ per cent. on the sulphide, the only source of grit in properly made detonators, are quite unobjectionable, provided the sulphide is passed through a 120-mesh sieve. Proportions of grit up to 1 per cent., or even more, would, under these conditions, probably have no measurable effect.

Velocity and Energy of Blow Required to Detonate 6.6.4. Mixture

A long series of experiments was carried out to find out the limits of velocity and energy which have to be applied to the needle to ensure the detonation of detonators filled with 6.6·4 composition. It was found that the minimum velocity was 1·6 ft. per second, while the minimum energy was about

2 in. ounces. Weight used.	Height of Fall.	Blow.
20 lb.	0·40 in.	128·0 in. ounces
4 lb.	0·50 in.	32·0 in. ounces
2 lb.	0·52 in.	16·6 in. ounces
1 lb.	0·55 in.	8·8 in. ounces
8 oz.	0·79 in.	6·3 in. ounces
5 oz.	1·17 in.	5·8 in. ounces
2 oz.	2·19 in.	4·4 in. ounces
½ oz.	5·50 in.	2·8 in. ounces
¼ oz.	27·0 in.	1·9 in. ounces

If the results are plotted, taking the height of fall as ordinates and the weights as abscissæ, the limiting values for velocity and energy are very clearly shown.

Effects of Pressure on the Detonation of Fulminate

A number of detonators were filled with fulminate of mercury and pressed at different pressures and tested by a modified comminution test for rapidity of detonation. The following pressures were tried: 600 lb., 1,000 lb., 2, 000 lb. and 3,000 lb. dead load on a detonator 0·25 in. diameter. In all cases the pressures and charges were regulated with extreme care, the former being in many cases actually measured. The following were the results obtained on firing these detonators:

At all pressures between 600 lb. and 1,500 lb. very good detonation was always obtained. At 2,000 lb. only one-third gave good results, while at 3,000 only one-fifth. At 2,000 lb. and 3,000 lb. extraordinarily bad results were obtained, in some cases the only damage that was done to the detonator being to straighten up the lug and to blow off the brass disc. These results, in view of the experiments on counterweight presses, given later, are of great importance.

The tests of the detonators were carried out as follows: A steel anvil with a cavity ¾ in. diameter and ¼ in. deep covered with a steel cap, with a central hole for the needle to pass through and with side vent holes, was used. At the bottom of the cavity was placed a steel washer $\frac{1}{10}$ in. thick with a hole ½ in. diameter, and on this washer a mild steel disc $\frac{1}{10}$ in. thick, the central part of which was therefore unsupported. In the centre of the disc was placed the detonator to be tested. The cap was then put on the anvil, a needle passed through the central hole so as just to rest on the detonator, and a steel ball weighing ½ lb. was dropped from a height of 12 in. on to the top of the needle by means of an electromagnet. Good detonation produced a deep cavity in the steel disc and, generally, a star fracture; bad detonation made no depression at all. Further indications as to good or bad detonation were given by the condition of the shell of the detonator after firng. It is interesting to note that the loudness of the report is no guide to the rapidity of detonation; in fact, bad detonations generally gave exceptionally loud reports.

Experiments with Counterweight-controlled Presses

We carried out a long series of experiments as to the pressures obtained when using presses in which the control is given by placing the mould on a movable table supported by a counterweight. We found that this method of control was extremely unsatisfactory in all cases, as, even with the greatest care in working, and moving the press handle so slowly that four or five times the normal time was taken, a press set to give a dead load of 600 lb. gave a minimum load of 650 lb. Ordinary work, such as is normally done in factories, gave mean pressures of about 1,200 lb., while it was possible to get 3,000 lb., or five times the correct pressure by very violent work. These results were strikingly confirmed later by the pressing of C.E. pellets. We proved, by a long series of experiments, what was the actual pressure required to produce the correct density in C.E. pellets of different diameters and lengths. For a certain pellet the correct load was 800 lb., but one of the factories that got the best results had their presses set to only 300 lb., the rest of the pressure being obtained by the rate of working the press.

In view of the results of overpressing on the detonation of fulminate these results were very important, and we therefore devised a system of spring control which made excessive pressures impossible.

There were at least three causes for these excess pressures. The first was the friction in the press, but this was not very important. The second was the initial blow received by the fulminate when struck by the drift. Owing to the inertia of the mould table and the counterweights this may be more than the total pressure to which the press is set. Thirdly, and most important of all, is the effect of the acceleration given to the weights. The press is set so that the weights when at rest give the required load; all the work done in giving the weights an upward acceleration goes to increase the total pressure obtained. All these were eliminated by our spring control.

The same difficulties, but with a further disturbing factor, occur with weight-controlled multiple presses where all the moulds are controlled by one weight. The rate at which the weight is lifted varies the mean pressure in exactly the same way as the pressure in the single press is varied. In addition, variations in filling cause a very large variation in the pressure given to single detonators. Both the capacity of the shells and the volume of the charge necessarily vary somewhat, and when a high charge is put into a small shell, as must happen sometimes, the length of the fulminate column is considerably

longer than the normal. This charge would then take a very undue proportion of the total weight, and it appears very likely that some of the multiple press explosions are due to this cause. On the other hand, when a small charge gets into a large shell the length of the fulminate column is considerably shorter than the average and would therefore get considerably less than the correct pressure.

A further drawback to the multiple presses, in our opinion, is the difficulty of cleaning the shells. When a multiple press is used the shells remain in the same tray for the whole time that they are being made, instead of being removed and cleaned directly after the pressing is done, as is the case when the single press is used. This is particularly objectionable when the detonators are varnished.

Jelly Bag Mixer

The jelly bag, although in almost universal use for fulminate mixtures, has several serious drawbacks. Among these are, first, that it is dirty; secondly, that it tends to break up the fulminate crystals; thirdly, that the sulphide of antimony has a strong tendency to stick to the material of which the bag is made, and to the leather funnel containing it. The first causes danger by scattering the mixture about the mixing house, the second tends to make the mixture run badly, the third causes part of the mixture to be of quite wrong composition, for the following reasons:—

After the mixture is finished the material is removed from the bag in three stages. First the bag is turned inside out, causing the bulk of the material to fall through the leather funnel into pots placed to receive it. The bag is then shaken by jerking the string attached to it, causing a further portion of the mix to fall into the pots; and lastly, the leather funnel is tapped to shake out the rest of the material. On a number of occasions we took samples of these three portions separately and analysed them, and the following are the mean results obtained:—

	First Part.	Second Part.	Third Part.
	Per cent.	Per cent.	Per cent.
Fulminate.....	37·3	35·7	27·6
Chlorate	38·4	38·3	37·8
Sulphide	24·1	25·6	35·0

the correct mixture being fulminate 37·5 per cent., chlorate 37·5 per cent., and sulphide 25·0 per cent. The proportion of sulphide found in the third portion varied from 32 per cent. to 45 per cent. We found, by experiment, that a variation of ± 1 per cent. in the proportions of the ingredients has no appreciable effect on the character of the mixture, therefore portions 1 and 2 are satisfactory, but portion 3 is very seriously wrong, and we therefore arranged that this portion should be rejected. The average amounts of the three portions removed were 85 per cent. at the first stage, 10 per cent. at the second stage, and 5 per cent. at the third stage. The bad portion is thus a small one, but as it forms a thin layer over the top of the correct mixture it is quite possible for the bulk of it to get into the first few detonators filled from the pot, thus making them of very bad quality.

We therefore devised a new form of mixing machine which completely obviated this trouble, and was quicker and much cleaner than the jelly bag. This was used with great success, and it was found that owing to the much smaller amount of damage done to the fulminate crystal, much better running mixes were produced than when the jelly bag was used. The mixer was so effective that in a very short time very uniform mixes of grained and mealed gunpowder could be produced, a very severe test.

The mixer consisted of a fluted pot of glazed earthenware, about 6 in. maximum diameter and 6 in. in depth. There were six flutings, each about 1 in. in depth. The pot was held by rubber-covered metal rods fitting in to the flutings. These rods were attached to a revolving shaft set at an angle of about 60 degrees with the vertical at a speed of about 40 revs. per min. The pot can be used either uncovered or with a silk cap held over the mouth by means of an elastic band.

Destruction of Fulminate

The question of the destruction of waste fulminate and fulminate mixtures became a very pressing one early in the war. From the very beginning we recommended the use of a cold solution of hyposulphite of sodium in large excess and efficient agitation. Later it was suggested that the destruction of the explosive properties of fulminate by this means was not permanent, but that the fulminate could be regenerated. We were able to prove that the destruction is complete and permanent, and that there is no possibility of any future danger being incurred when this method of destruction is employed, provided that a good excess of hyposulphite is used and the the mixture efficiently agitated, both points we had very strongly emphasised when we first recommended the process. If insufficient hyposulphite is used some of the fulminate is dissolved, without chemical change, in the cyanide solution produced by the decomposition of the rest of the fulminate, and this, on standing, may crystallise out unchanged as fulminate of mercury.

Shortly after we had made the above recommendations, a somewhat serious accident occurred during the attempted destruction of detonators by boiling in hyposulphite solution. This made the question of the safety of this method a very urgent one, and we therefore carried out a long investigation into the chemical processes involved.

We found, however, that although the preliminary solution of the fulminate involved no evolution of heat, secondary action took place which did evolve heat and that this action was the more marked the higher the temperature at which the solution took place, and there is little doubt that this secondary action was the cause of the accident. We were able to prove, however, that if the destruction is carried out in open vessels at ordinary temperatures no danger is incurred.

We entirely disapproved of the attempted destruction of filled detonators by means of hyposulphite solution, either by boiling, which is dangerous, or in the cold, which is unsatisfactory owing to the impossibility of insuring that the solution permeates the whole of the pressed material, especially when protected by varnish or otherwise. We have frequently pointed out that, even in the case of loose fulminate, efficient agitation is necessary to ensure complete destruction.

We are strongly of opinion that the most satisfactory method of storing detonators that are to be destroyed is to keep them covered with dilute hypo solution, which decomposes any exposed fulminate, and that the best method of destroying them is to burn them, a few at a time, in well-heated especially-constructed furnaces.

Chemical Trade in Holland

JUDGING from the pamphlet issued by the Department of Overseas Trade, the Chemical Industry of Holland is not in an exactly thriving condition. During the first half of the year conditions were very unfavourable, and production decreased considerably as compared with the output for 1918. This state of affairs was not improved by cheap imports during the latter months of 1919, which were made possible by the low exchanges of neighbouring countries. The manufacture of sulphuric acid increased during the year owing to smaller imports from Germany and Belgium; also on account of the home market being brisker.

The manufacture of synthetic dyes was developed considerably during the year, but the fertiliser industry was hampered by irregular and small imports of phosphates and pyrites. The general position, however, is improving.

Raw materials for the manufactures of varnish, paint, and enamel were in constant demand for Spain and Switzerland, though export to former markets such as Germany and Austria was impossible. The markets at home and in the countries where the exchange had not suffered severely were sufficiently brisk to keep paint factories working to their fullest capacity. Prospects were therefore considered good unless the imports of raw materials, such as lithopone, zinc-white, &c., from Germany, and other articles required in this industry from England were not forthcoming.

The glucose factories were in the course of the year enabled to resume work, but owing to shortage of raw material the output was still far below the pre-war average.

If a judgment may be formed from the general attitude of the public, and from the tone of the Press, it is more than probable that the Netherlands will remain a free-trade country. There have been no signs of agitation for the imposition of restrictions on the import trade.

Cellulose Acetate from the Colloidal Standpoint

By Gustavus J. Esselen

At a recent meeting of the American Chemical Society Mr. Gustavus J. Esselen, a member of the staff of Arthur D. Little, Inc., dealt with certain aspects of the chemistry of cellulose acetate from the colloidal standpoint. In view of the increasing attention given to the study of colloids and its bearing on the manufacture of cellulose acetate we reproduce below the substance of his paper.

If one were asked for a good example of a colloidal solution in a non-aqueous solvent, probably among the first materials to come to mind would be solutions of cellulose esters. In spite of this, it is only comparatively recently that the colloidal character of the parent substance cellulose has been recognised. Harrison* has correlated in a most interesting manner many of the reactions of cellulose, as, for example, its behaviour when treated with alkalies, acids or oxidising agents, by considering the typical cellulose, cotton, as existing in a number of different degrees of colloidal dispersion. Cross† has also referred to cellulose as a colloid, and Miss Minor‡ has recently considered the hydration of cellulose in paper making from the standpoint of colloid chemistry. Whether or not the solution of the problem of the constitution of the cellulose molecule is ultimately to be found in these colloidal considerations, the point of view which they present is certainly helpful in correlating many previously unconnected observations. Once it is admitted that cellulose is a colloid, all its transformations are to be considered as colloid chemical processes, and as such involve one or more of the various phenomena, such as adsorption, change in degree of dispersion, &c., which we have come to associate with materials in the colloidal state.

This is not the place, nor is there time, to discuss at any length the underlying principles of colloid chemistry. There is, however, one phase of the matter which it is well to keep constantly in mind, and that is, that in substances dispersed colloidally the surface is unusually great in proportion to the mass. This being so, we should expect all surface phenomena to be emphasized. We shall have special occasion to refer to the particular surface phenomenon of adsorption, which Langmuir§ considers to be intimately connected with the time lag between the striking of an iron or molecule on a surface and the rebounding from that surface. This gives a picture of the process which helps to fix in the mind some of the particular steps which are referred to later. Miss Minor‖ has pointed out that where cellulose is under consideration, another of Langmuir's postulates also seems to have particular significance; that is, his definition of a colloid molecule as a large aggregate of atoms or group molecules held together by secondary valence.

Catalytic Action of Sulphuric Acid

In its simplest terms, cellulose acetate is formed by the esterification of cellulose by means of acetic anhydride in the presence of a catalyst. There are two general methods of producing cellulose acetate, both of which have a number of variations. One results in a fibrous acetate resembling in outward appearance the original cotton used as raw material; the other gives a granular product. In all methods the most common catalyst is sulphuric acid dissolved in acetic acid, which acts as a carrier. In some instances the cellulose is first given a preliminary treatment with the mixture of sulphuric and acetic acids, sometimes in the presence of a little water. The treatment is often referred to as a hydration, but its exact nature has not been established. Whether or not a preliminary treatment is given before adding the acetic anhydride, the sulphuric acid is adsorbed by the cellulose from the solution. These sulphuric acid-cellulose compounds were at one time considered to be true molecular compounds, but they are now recognised as adsorption compounds, forming a series in which the percentage of sulphuric acid varies by much more gradual changes than could be accounted for on the basis of simple molecular proportions. This either results in, or is accompanied by a swelling and peptisation of the cellulose to an extent depending upon the temperature and time. As indications that the degree of dispersion is really modified, there may be cited the observations that the longer the preliminary treatment, the more rapid the subsequent esterification and the less viscous the solutions of the product. The success of the process is doubtless due quite as much to the modification of the colloidal state of the cellulose as to the usual effect of the catalyst in facilitating esterification. In this latter connection it may be noted that because of being right on the surface where the reaction must take place, the catalyst is in a peculiarly effective situation for promoting the esterification.

In making the granular form of cellulose acetate, cellulose, usually in the form of cotton, is treated with a mixture of acetic acid, acetic anhydride, and a suitable catalyst. The acetic acid acts merely as a carrier and takes no part in the reaction. As mentioned above, the catalyst dissolved in acetic acid is frequently mixed with the cellulose some time before the anhydride is added, although in other cases all are added together. Since cellulose acetate is soluble in acetic acid, the cellulose dissolves as the esterification proceeds. Samples are taken from time to time, and when the desired solubility has been attained, the reaction is stopped by adding an excess of water which destroys any remaining anhydride and precipitates the cellulose acetate. In the earlier processes, the acetate thus formed was the tri-acetate corresponding to the hexanitrate. It later developed* that owing to their wider range of solubility the acetates of most technical usefulness were those with a somewhat lower acetyl content than would correspond to a hexa-acetate on the C_{12} basis, but higher than would correspond to a penta-acetate. These were at first prepared by adding small and carefully regulated amounts of water and sulphuric acid to the solution of cellulose acetate in acetic acid. As before, when the desired solubility was attained, the product was isolated by precipitation with water. While outwardly this secondary treatment is one of partial saponification, it is actually much more intimately connected with the colloid properties of the cellulose acetate. The reason for this statement is that an equivalent degree of saponification obtained by methods not involving the solution of the acetate does not give a product with the same wide range of solubilities. The effect may very possibly be connected with the opening up of the molecule in such a way as to make the —CO group more reactive, because it results in a greatly increased solubility in acetone.

In preparing cellulose acetate in fibrous form, it is given a preliminary treatment with sulphuric acid dissolved in glacial acetic acid, this step being similar to the one for preparing granular cellulose acetate. After removing the surplus preliminary bath in a centrifuge or press, the cellulose is immersed in a mixture of acetic acid, acetic anhydride, and some non-solvent hydrocarbon like kerosene, or benzene. While the proportion of non-solvent is so regulated that the cellulose acetate does not dissolve, the conversion is accompanied by a marked swelling and by a noticeable change in the index of refraction. When the product has reached the desired degree of solubility, the surplus bath is removed, and the residue thoroughly washed with water. The product is cellulose tri-acetate, which is subjected to a partial saponification to render it soluble in acetone.

Cellulose Acetate Solvents

One of the earliest solvents for cellulose acetate was chloroform, and it was soon noticed that solutions in this solvent were markedly improved by the addition of small amounts of alcohol. The improvement in solubility passes through a maximum and then gradually falls off until finally a proportion of alcohol is reached which gives a mixture with chloroform in which cellulose acetate is no longer soluble. So far as I know, no explanation has ever been offered for this behaviour. A possible explanation may be found if we remember that cellulose and its compounds have marked affinity for hydroxyl groups.

* *Trans. Nat. Assoc. Cotton Mfgrs.*, 101 (1916), 201. 2nd Report on Colloid Chem. Brit. Assn. Adv. Sci., 1918, 52.
† *J. Soc. Dyers Colourists*, 34 (1918), 92.
‡ *Paper*, 25 (1919), 700.
§ *J. Am. Chem. Soc.*, 36 (1914), 2,221; 39 (1917), 1,849.
‖ *Loc. cit.*

* *Ost. Z. angew. Chem.*, 32 (1919), 66, 76, 82; *Chem. Abs.*, 13. (1919), 2,760.

In fact, if the size of the negative charge* assumed when immersed in water is a reliable criterion, cellulose acetate has a considerably greater affinity for hydroxyl groups than cellulose has. When alcohol is added to a chloroform solution, it may be that the cellulose acetate adsorbs the alcohol, in which case the hydroxyl groups would probably be next the cellulose acetate, and the hydrocarbon radicals would be sticking out into the solution. Reasoning from the analogous effect of a dilute sodium hydroxide solution on cellulose, a slight swelling of the cellulose acetate might well be assumed with the possibility of an accompanying increase in dispersion. This may be one of the effects entering into the improvement in solubility when alcohol is added. A second effect may be that the hydrocarbon groups exert more of an attraction on the hydrocarbon end of the chloroform molecule than does cellulose acetate itself, which would also tend to improve the solubility. The maximum point in the curve may correspond to the point at which all the secondary valences of the surface of the cellulose acetate are just saturated with alcohol. Since the cellulose acetate is in a colloidal degree of dispersion, its surface will be large and a considerable amount of alcohol will be required. In practice, this point is reached when alcohol constitutes about 25 to 30 per cent. of the solvent mixture. Inasmuch as alcohol is not itself a solvent for the usual forms of cellulose acetate, any more than dilute caustic soda solutions are solvents for cellulose, it is natural that further additions of alcohol should gradually tend toward making the mixture a non-solvent. There is a further analogy between the action of dilute caustic soda solution on cellulose and that of alcohol on cellulose acetate, in that certain forms of cellulose acetate are known which are soluble in hot alcohol, corresponding to those forms of cellulose precipitated from zinc chloride or cuprammonium solutions, which are soluble in aqueous alkalies

Another interesting example of the beneficial effect of alcohol is in connection with aromatic hydrocarbons. Cellulose acetate is not soluble in benzene either at room temperature or at the boiling temperature. However, if a certain amount of alcohol is added to the benzene, the mixture becomes a solvent for the cellulose acetate when warmed. This is true even with those varieties of cellulose acetate which are not soluble in hot alcohol. Here again, we may have the same explanation as in the previous instance, *i.e.*, the alcohol may be adsorbed and the hydrocarbon radicals may be sufficiently attracted by the benzene to cause the cellulose acetate with its adsorbed alcohol to go into solution.

One might at first sight, think that if this proposed theory were correct, mixtures of aliphatic hydrocarbons and alcohol should also be expected to act as solvents for cellulose acetate, which is not the case. On further consideration it will be seen that the fact that aliphatic hydrocarbons and alcohol are not solvents for cellulose acetate is merely another piece of evidence that the theory is really the true explanation. From the fact that heat is required to effect the solution of cellulose acetate in mixtures of benzene and alcohol, we may conclude that the attraction between the adsorbed alcohol and the benzene is very near the minimum amount required for solution. If the attraction were very much less, we should not get the resulting solubility. Now we know that benzene has much more of an attraction for alcohol than have the aliphatic hydrocarbons ordinarily met with in petroleum solvents such as gasoline or kerosene. These relative attractions are well illustrated by the fact that kerosene and gasoline are not miscible with ethyl alcohol, except in very small proportions, whereas alcohol and benzene are readily miscible. Therefore, since the attraction between benzene and alcohol is just about the minimum necessary to bring the cellulose acetate into solution, and since the attraction between alcohol and the ordinary aliphatic hydrocarbons is distinctly less, it is not to be expected, if the proposed theory is correct, that the latter mixtures would be solvents of cellulose acetate. It is seen, therefore, that the solubility in alcohol and chloroform is intimately connected with the solubility in alcohol and benzene.

As an outcome of this consideration of the reason for the solubility of cellulose acetate in mixtures of benzene and alcohol, it would naturally be expected that if the theory held true, such materials as combined an aromatic radical and a hydroxyl group in one molecule should also be solvents for cellulose acetate. This is known to be true, since the phenols as a class are among the very best solvents for cellulose acetate.

* *Trans. Nat. Assoc. Cotton Mfgrs.*, 101 (1916), 218.

Summary

To sum up, it is pointed out that it is not unreasonable to expect that when ethyl or methyl alcohol is added to a chloroform solution of cellulose acetate, the alcohol is adsorbed by the colloidal cellulose acetate, the hydroxyl groups probably being nearest the surface of the cellulose acetate particles. The resulting improvement in solubility which occurs may then be explained as due to a combination of two effects; first, a swelling and possible increase in the degree of dispersion of the cellulose acetate; and second, a greater attraction for the chloroform by the simple hydrocarbon radical of the alcohol than by the more complex cellulose acetate. The theory is extended to explain the solubility of cellulose acetate in mixtures of alcohol and benzene and in phenols, which, as a class, are excellent solvents for cellulose acetate.

There are, then, two classes of solvents for cellulose acetate whose solvent properties may be, to a certain extent, at least, explained. In the first class are those solvents like acetate acid, ethyl acetate, and triacetin which contain acetyl groups and whose solvent action is to be explained on the ground that they are presumably of the same general type as cellulose acetate. In the second class are certain compounds and mixtures containing hydroxyl groups combined with aromatic or certain of the simpler aliphatic hydrocarbon radicals, the solvent action of which has been explained above.

It is recognised that there are still other solvents of cellulose acetate which are not included in either of the above general divisions, and it is hoped that a correlation can later be made of many of the observed phenomena in these instances also.

Water Concession for Ammonia Plant

THE Italy-America Society announces that an American has secured from the Italian Government a concession for the utilisation of 800 H.P. of the waterfalls at Terni, about 70 miles from Rome, for the production of nitrogenous plant food. At the Terni plant the manufacture of ammonia through the agency of water-power has passed the experimental stage, and synthetic ammonia has already been put on the market on a paying basis. No raw materials are used. The factors in the equation are simply water, air and electric energy. Liquid air has no part whatever in the process.

The first step is the decomposition of water into hydrogen and oxygen by electrolysis. The hydrogen is stored in large tanks, and is conveyed thence to a receptacle where the essential part of the process is carried out, the details of which are kept secret. The last link in the chain of production is the application of tremendous pressure, running up to as high as 250 atmospheres, to the resultant gaseous products. Synthetic ammonia issues from the plant in portable steel cylinders. With its present equipment the plant is capable of producing 1 ton of ammonia daily.

Electrolytic Zinc Co. to Produce Alkali

The Electrolytic Zinc Co. is now successfully established at Risdon, Tasmania. Within the next few weeks it is expected the weekly output of electrolytic zinc from the company's plant will be increased from 100 tons to 140 tons by the use in portion of the large new plant of an extra 1,750 H.P. of electric energy to be supplied under arrangement with the Tasmanian Government. Construction of the first half of the new 100 ton zinc plant is being steadily advanced, and work on the buildings and plant for the treatment of by-products and the development of subsidiary industries is also proceeding. As has been announced on previous occasions in the general programme of projected undertakings by this company, further consideration has been given to the production of caustic soda, chlorine and chlorine products, and it is the company's intention to proceed as soon as practicable with the production of 6,000 to 8,000 tons annually of caustic soda, with a corresponding quantity of chlorine and chlorine products, using for this purpose the plant and buildings of the present 10 ton zinc plant. After investigation these have been proved to fit in very reasonably with this new industry. For instance, the electrical equipment at present being used for the manufactue of zinc will need practically no alteration to adapt it to the production of electrolytic alkali and chlorine.

Death of Sir Norman Lockyer

WE regret to announce the death of Sir Joseph Norman Lockyer, which occurred at Sidmouth on Monday last.

His name has been famous since the year 1868, when, independently with Jannsen, he discovered that the solar chromosphere could be seen in broad daylight. The discovery has lost some of its meaning for the younger generation, but at the time an enthusiastic French Academy struck a medal in honour of the two men. In the same year Lockyer and Frankland discovered in the sun's spectrum an element which has been very much in the public eye of late—Helium.

Lockyer was born at Rugby, on May 17, 1836, and received his first lessons in science from his father, who was one of the early workers on the electric telegraph. He was educated in various private schools and on the Continent, and received an appointment at the War Office in 1857. His work there was so much appreciated that in 1865 he was appointed editor of the Army Regulations. In 1870, he was made secretary of the Duke of Devonshire's Royal Commission on Science, an appointment, no doubt, due as much to his scientific achievements of 1868 as to his proved business ability, and at the end of the labours of the Commission he was transferred to the Science and Art Department. In the same year (1875) he received the Janssen medal of the Paris Academy of Sciences and was elected a corresponding member.

His scientific work, begun as a pastime, soon became the business of his life. He wrote books, and to study the outlying portions of the sun he went on many eclipse expeditions to distant quarters of the globe. His research work was chiefly in the domain of solar and stellar physics, and he contributed over 200 papers to the subject, but he summarised much of it in two important works, the "Chemistry of the Sun" (1887), and the "Meteoritid Hypothesis" (1890). The latter was an attempt to bring all the known phenomena of the heavens under one heading. All the heavenly bodies—nebulæ, variable stars, double stars, comets, or what not—Lockyer maintained were aggregations of meteors under different conditions. It was an ambitious but masterly piece of theorising, and though there is now little hope of its taking a permanent position as an accepted hypothesis, it undoubtedly acted for a time as a great stimulus to thought and work. A most important feature of his work was the close association of the observatory and the laboratory, so that the same observer could pass immediately from celestial spectra to terrestrial and back again.

It was in 1869 that Lockyer started *Nature*, and as a weekly scientific journal it soon firmly established itself as a success.

The first words in the new journal were penned by Huxley, who began by translating Goethe's rhapsody on Nature. Huxley had himself had experience of the difficulties of maintaining a scientific journal, and it is testimony to the qualities which Lockyer brought to this work that he should have succeeded where Huxley had failed. He was generous in his congratulations to Lockyer at the dinner given to the contributors by the publishers in 1894 on the completion of the first 50 volumes of *Nature*; and he again took up his pen to introduce the 51st volume. Last year its founder enjoyed the unusual pleasure of contributing himself to the special number by which *Nature* celebrated its 50th year of life.

Lockyer was honoured by many societies and was elected F.R.S. in 1869. In 1903-4, as President of the British Association, he delivered a great address on our national need of more universities, pointing out that we were neglecting "brain-power" as we had formerly neglected "sea-power," and boldly suggesting as remedy: "Duplicate the Navy Bill of 1888-9; do at once for brain-power what we so successfully did then for sea-power." The address produced an undoubted impression, and led to a joint deputation of universities and learned societies to the Government, but nothing of importance came of it. A better fortune awaited another suggestion made in the earlier part of the address, for the formation of a British Science Guild, which was carried into effect forthwith. He was President of the Guild in 1912.

Sir Norman Lockyer, who was created a K.C.B. in 1897, married first, Winifred, daughter of Mr. William Janes, of Trabinshon, near Abergavenny, who died in 1879, and secondly, in 1903, Mrs. Bernard E. Brodhurst, daughter of the late S. E. Browne, of Bridgwater and Clifton. He had four sons and two daughters.

Funds for Chemical Studies at Oxford

IN a contribution to *The Times*, Professors W. H. Perkin (Waynflete Professor of Chemistry), F. Soddy (Lee's Professor of Chemistry), and Benjamin Moore (Whitley Professor of Bio-Chenistry) draw attention to the state of poverty of the Science School at Oxford, and in particular of the various departments of the School of Chemistry.

The most pressing and also the largest requirement, they state, is a new building for the department of physical and inorganic chemistry, including radio-activity. The following facts may serve to illustrate the almost unbelievable state of insufficiency of the university accommodation in this subject. Last year there were 230 students reading for the Honours School in chemistry, and this year 300 are expected. There will also be a large number of men engaged in research. Other students, to the number of about 220, require practical instruction in some branch of chemistry. The university department in question is provided with 18 benches only for the regular honours work and 36 benches for elementary work. The lecture room is much too small to admit the numbers wishing to attend even the honours courses. Until an entirely new building is provided for the department of physical and inorganic chemistry, many of the other science departments are hemmed in and unable to expand, and it is agreed that the provision of this building is a necessary first step towards growth of any kind.

The cases of organic chemistry and of bio-chemistry are hardly less urgent than the case of physical and inorganic chemistry. A large extension of the new organic chemistry laboratories is now under construction, but the funds necessary to meet this expenditure (£40,000) are not available. The new chair of bio-chemistry, recently endowed through the generosity of Mr. Edward Whitley, has still to be provided with a permanent home, and must in the meantime seek accommodation in the already overcrowded physiological laboratories.

As a start towards putting the science departments upon a proper footing, at least a quarter of a million pounds is necessary for new buildings and equipment at once, and, since no mistake is so common as to erect buildings without adequate funds being available to maintain and work them, an endowment bringing in £10,000 a year must be at the command of the school, if its various departments are to fulfil their proper function in producing knowledge as well as disseminating it. Donations towards the improvement of the chemistry school may be sent to any of the Professors named.

Reported Fusion of Lever Brothers and Pears

IT is stated that a circular has just been issued to shareholders of Lever Brothers announcing the terms of a provisional arrangement with A. & F. Pears, whereby the fusion of the two companies will be made complete.

At present Levers hold 150,000 of Pears ordinary shares, and the following are the chief points of the proposals now submitted: For every eight Pears 12 per cent. cumulative preferred ordinary shares, eight Lever Brothers 7 per cent. preference shares and eight Lever Brothers 8 per cent. preference shares to be given; for each Pears £10 6 per cent. cumulative preference share ten £1 Lever 7 per cent. preference shares to be given.

Lever Brothers 7 per cent. and 8 per cent. preference shares were quoted yesterday at 19s. and 20s. 6d., and Pears 12 per cent. preferred ordinary and 6 per cent. preference shares at 1⅛ and 8 respectively.

Taking Pears preferred first, the 8 per cent. shares would be worth £13, and in exchange they are to receive shares in Levers worth £15 or £16 at present quotations. In the case of Pears £10 6 per cent. preference shares valued at 8¼ holders will receive shares in Lever Brothers worth £9 or £10.

The Sunturbo-Meldrum Pump

Mr. W. D. Vanderbilt, of the National Aniline & Chemical Co., 21, Burling Slip, New York, writes: "In THE CHEMICAL AGE of June 19 there is an article on the Sunturbo-Meldrum Pump. We shall be very pleased if you will obtain information for us on this pump, asking the maker to send us such literature as he may publish." The makers of the Sunturbo-Meldrum Pump are Meldrums, Ltd., engineers, Timperley, Manchester.

Chemical and Dyestuff Traders

Correcting Some Misapprehensions

In a statement just issued, Mr. F. T. T. Reynolds, chairman of the Executive Council of the Chemical and Dyestuff Traders' Association, deals as follows with some imperfectly informed criticism of the Association's position and policy :—

"The assumption that the Chemical and Dyestuff Traders' Association has been formed in a spirit of rivalry and antagonism to another association is entirely unfounded and unjustified.

"The actual facts are that a number of important and old-established firms of merchants importing, exporting and trading in chemicals and dyestuffs, came to the conclusion that it was, under present conditions, advisable and, indeed, essential that there should be a medium provided for collective action, and as an effective mouthpiece definitely and distinctively for the distributing section of the trades concerned. The manufacturers and the consumers each possess their own distinctive organisations, and prime importance is attached to the traders as such being properly and comprehensively organised.

"It was known that an association had been formed some time ago called the British Chemical Trade Association, but its name as a trade association and not specifically as a traders' association did not suggest that it was a suitable medium for achieving the ends in view. Such an opinion was confirmed by its appeal being to 'all who may be interested in any way in chemicals or the chemical trade.'

"This vague and ambiguous basis probably accounts for the fact that many of the more important and old-established traders in chemicals and dyestuffs did not join the British Chemical Trade Association.

"The advantages to all concerned of having one powerful and comprehensive association are too obvious to need recapitulation, and I would submit that an organisation now exists able and willing to accomplish all that is desired. Until a few days ago the Chemical and Dyestuff Traders' Association had never been directly or officially approached by any other association, but I am quite certain that our Executive Council would be ready and willing to consider any reasonable suggestions with a view to promoting a working arrangement ensuring united action."

Pacific Phosphate Recovery

In their report for 1919 the directors of the Pacific Phosphate Co. state that shipments of phosphate during that year were considerably less than in the preceding year on account of the exceptional difficulty in engaging tonnage. As a result the profit for the year was appreciably reduced. Since the end of 1919 there has been a marked improvement in the position, and during the first six months of the current year the output has exceeded that for the whole year 1919 and higher prices have been realised. Having regard to this improvement they propose to pay an interim dividend of 10 per cent. (actual) on the ordinary share capital in respect of the half-year ended June 30 last, simultaneously with the final dividend for 1919.

The accounts show that the balance of the war contingency reserve (£25,000) has been transferred to profit and loss, and after providing for the dividends on the preference shares to the end of December last and for an interim dividend on the ordinary shares of 2½ per cent. for the half-year ended June 30, 1919, there remains for disposal £29,961. Out of this it is proposed to pay a final dividend on the ordinary shares for 1919 of 4½ per cent. (making, with the interim dividend, 7 per cent. for the year), and to allocate as additional remuneration to the directors for the year 1919, £1,969, leaving to carry forward £2,679. The final dividend for 1919, together with the interim dividend for the half-year ended June 30, 1920, will be paid on September 3.

The Hull justices last week dismissed a charge against Edward Hindle, chemist, under the Food & Drugs Act, of selling a bottle of quinine wine deficient in quinine hydrochloride to the extent of 17 per cent., deficient in alcohol to the extent of 62·3 per cent., and containing salicylic acid to an extent equal to 3·5 grains per pint. The defence was that the wine was purchased in July 1919 from a reputable Leeds firm, and the defendant relied on the manufacturer's warranty.

Liverpool Nitrate Fusion

Amalgamation with San Lorenzo and Buena Ventura

At an extraordinary general meeting of the Liverpool Nitrate Company on Thursday week, approval was given to a scheme by which the Liverpool Company acquires the undertakings and properties of the San Lorenzo and Buena Ventura Nitrate Companies. The Liverpool Company will give to the shareholders of the San Lorenzo Company in exchange for each of the latter's £1 shares one 5s. share (fully paid up) in the Liverpool Company at present standing on the Stock Exchange at 4¼ to 4⅜. The agreement with the Buena Ventura Company provides that the shareholders in that company are to receive one 5s. share (fully paid up) of the Liverpool Nitrate Company, in respect of every seven shares in the Buena Ventura Company, and also a cash payment of 5s. on each of their shares. The amalgamation in each instance takes effect from June 30 last.

Liverpool Shareholders Approve

At the meeting of the Liverpool Company the chair was occupied by Sir Robert Harvey, who said that the terms of the provisional agreement were arrived at after very careful consideration. It was the unanimous opinion of the Liverpool Company's directors that if the shareholders approved of the terms they would acquire two valuable properties on very advantageous terms. They had no hesitation in recommending the confirmation of the provisional agreements. The schemes were highly advantageous to all parties. The records of the San Lorenzo Nitrate Company showed that since its incorporation 5,462,457 quintals of nitrate had been produced. The property was estimated to contain still 9,484,121 quintals of nitrate, which on the basis of 65 per cent. yield gave 5,264,679 quintals. The existing plant, with the present system of manufacture, could be modified, and its productive capacity increased from 25,000 to 50,000 quintals per month, at an outlay of £50,000. Even if it were to cost double that amount, the margin between the present cost price and selling price of nitrate would recoup the outlay. As to the Buena Ventura Company, the manager was confident that substantial profits could be made at present prices, which would be considerably increased when the oil-burning equipment at present on order was installed. For 33,075 Liverpool shares of the nominal value of £8,269, in addition to £17,000 in cash, they acquire two going nitrate establishments with an allotted shipping quota of 54,000 quintals a month, and grounds estimated to contain nearly 14,000,000 quintals of nitrate of soda and nitrate of potash. There were, besides, many other advantages which would follow the amalgamation. The directors of the Liverpool Nitrate Company were unanimously of opinion that the proposed fusion with the San Lorenzo and Buena Ventura Nitrate Companies was a highly advantageous one to them, which opinion was still further confirmed by the success of the two previous amalgamations with the San Donato and the Colorado Nitrate Companies.

On the motion of the chairman, the necessary resolutions were passed approving the dual amalgamation.

San Lorenzo Proprietors Agree

Mr. W. H. Hasler, who presided at a meeting of the San Lorenzo Company held subsequently, expressed the opinion that the amalgamation proposed would be a mutual advantage. The conditional agreement was duly approved, and Mr. H. H. Robson was appointed liquidator for the winding-up of the San Lorenzo Company, which is a formal preliminary to the amalgamation. The Buena Ventura have also agreed.

Synthetic Camphor

Professor Mailhe, a French chemist, states that synthetic camphor is prepared quite simply in three steps from the pinene of the essence of turpentine. Gaseous hydrochloric acid converts the pinene into a solid hydrochlorate, and this is changed to camphene by ammonia, pyridine, or any one of many methods. The camphene is hydrated into borneol by heating in a water-bath with glacial acetic acid and about 2 per cent. of sulphuric acid. The borneol is transformed into camphor by oxidation by air, oxygen, ozone, or other agent; or by dehydrogenation by passing the borneol vapour over finely-divided copper heated to 300° to 330°C., thus splitting the compound up into hydrogen and camphor. The success of this artificial camphor may depend on a lowering of the present high cost of turpentine and hydrochloric acid.

From Week to Week

COMMANDER C. W. CRAVEN, special director of Vickers, Ltd., Barrow, has joined the Board of Sapon Soaps, Ltd.

A company for the manufacture of aniline dyes has been formed at The Hague. It is believed to be backed by German financiers.

The German dye industry has arranged to supply to the Czecho-Slovak cotton mills (2,104,000 spindles) all the dyes they need.

A graduate research studentship at Emmanuel College, Cambridge, has been awarded to C. H. Spiers, B.A., for research in stereo-chemistry.

THE death is announced of Mr. James Baxter, of Grangemouth, at the age of 72. He had been in business as a chemist for 50 years, and retired two years ago.

During 1919 the production of crude oil in Egypt amounted to 231,180 tons, being a reduction of 42,120 tons over 1918. Arrangements are in progress to increase the output during the next twelve months.

THIRTY members of the Society of Glass Technologists in charge of Professor Turner, of Sheffield University, left Liverpool on Saturday on their way to attend by invitation of the American Ceramic Society an international conference at Pittsburg, where scientific and technical questions will be discussed.

A new fertiliser, known as "Ephos" basic phosphate, has been made from phosphate mined in Egypt. It contains from 60–65 per cent. of tricalcium phosphate, of which 85–95 per cent. is soluble in 0·2 per cent. citric acid solution. The new fertiliser, of which over 30,000 tons have been exported to New Zealand and small quantities to England, is said to be suitable for wheat and root crops as a substitute for basic slag or superphosphate.

A French company has been formed by some of the large railway and shipping companies for the purpose of supplying oil fuel to its members and assisting the French Government as far as possible. The board is composed of representatives of the P.L.M., the Nord, the Est and the Paris–Orléans railway companies and of the following shipping lines: Compagnie Générale Transatlantique, the Chargeurs Réunis, the Messageries Maritimes and the Compagnie Sud-Atlantique.

A BILL has been presented to Parliament by Sir John Baird, Under Secretary for the Home Office, to make provision for the better protection of women and young persons against lead poisoning. It is entitled the Women and Young Persons (Employment in Lead Processes) Bill, and prohibits the employment of women and young persons in certain processes of the manufacture and regulates their employment in processes involving the use of lead compounds.

According to the annual report of the Elberfelder Farbenfabriken, synthetic rubber has no prospect of success in competition with the natural product. Larger quantities are now stored in London than before the war; moreover, there has been a marked increase in the cost of raw materials, especially of acetone and aluminium. The factory, having used up all its raw material, has been lying idle since the revolution in 1918, and, although no actual loss has been incurred, there is no immediate prospect of re-starting it under present conditions.

For some considerable time the Forth and Clyde Steel Smelting Co have been finding their works at Kirkintilloch somewhat limited, and they have now acquired the buildings and ground at Lennoxtown, formerly occupied by the Underwood Chemical Co., but unoccupied for many years past. The Company are losing no time in the reconstruction of the works to suit their requirements, and once the new works are in full swing employment will be given to many workers in the district.

On Sunday morning an explosion occurred on the sailing barge "Dorcas," off Woolwich. The vessel was loaded with petrol, and, breaking adrift, set fire to two tugs lying beside her. In the course of her drift down the river she set alight to the Woolwich Free Ferry, and also to a couple of barges laden with wool. The barge was flooded, and as she sank shot up a mass of flame. Three of the brigade pumps were severely damaged, and about thirty men had a narrow escape from death. The skipper of the vessel, William Hallett, is missing, and presumed dead.

The annual Japanese production of phosphorus is valued at over £3,000,000, and two-thirds of this is exported, yet the raw materials were almost entirely imports in pre-war days. Absence of Swedish competition, however, popularised Japanese matches in certain quarters, so that the manufacture of the raw materials, including phosphorus, was developed at home. Phosphatic ore is chiefly obtained from Raça Island, Lu-Choo, where the ore, containing 14·63 per cent. of phosphorus, is of the best quality. The production of ore in recent years has been: 1908, 740 tons; 1913, 1,057 tons; 1918, 114,810 tons.

The President of the Board of Trade states that the total quantity of synthetic dyestuffs, including a small quantity of intermediates, imported from Germany during the first six months of the current year was approximately 387 tons, of which about 150 tons were received under the Reparation Clauses of the Treaty of Versailles. This, says a correspondent in *The Times* Trade Supplement, is not a large amount, but with the increasing British supply there is much less grumbling in dyeing circles. The demand for bright colours is, if anything, accentuated, and the trade is meeting it very well. Bright colours are much in vogue at present, and the shade cards for the autumnal season show a preponderance of vivid tints.

A BUKAREST correspondent states that a Bill will be introduced in Parliament shortly regulating the export and home distribution of oil products. According to this Bill the export will be made free, subject to the payment of an export tax not exceeding 20 per cent. Should this basis, however, not stand competitive prices abroad, it could be reduced accordingly. Internal trade will be regulated by the State through a new private company to be formed, in which producers will participate to the extent of 50 per cent., together with consumers and the State with 25 per cent. each. Foreign and Rumanian oil producing companies will participate on an equal basis in the new company, and the already existing distribution companies engaged in the Rumanian petroleum industry will also be given a participating share.

THE premises of the International Trust Company on the outskirts of Luton, used as a breaking-down factory for small arms ammunition, were destroyed by fire on Saturday morning. A huge quantity of small arms ammunition and 200 tons of explosive and smoke powder were stored on the premises, and the fire caused an explosion which shook the town. Half the building, which was 250 ft. long, was blown down and a great number of rounds of ammunition was destroyed with a noise like machine-gun firing. Six men working in the building at the time had remarkable escapes. Five of them received burns, and a fireman was struck by a flying bullet and suffered severe injury to an eye. Iron window frames and masses of brick-work were thrown a great distance. Bullets and fragments of shell were picked up three-quarters of a mile away.

MR. V. LEFEBURE, formerly Major, Chemical Warfare Liaison, in a letter to *The Times* on the control of chemical warfare, writes:—"It is most important that the facts of chemical warfare should not be misrepresented, nor the significance of the dye industry misunderstood in this connection. The abolition of war is an ideal which must be held by most thinking soldiers and civilians. But it is not so generally understood that for one particular branch of warfare, chemical warfare, it is not possible to secure abolition by prohibition, whatever controls be instituted. The peculiar association of chemical warfare and the organic chemical industry in Germany during the war established this beyond doubt when controls were considered in the Paris Peace negotiations. There are no efficient controls. This being so, we can either once again trust to international agreements and sentiment, or adopt some precautionary measure in addition. No responsible person can ask the country once more to trust entirely for protection in this vital matter to sentiment. This implies trust in a word already broken, the word of a country still stronger in the particular weapons with which it offended. We must establish a dye industry to cover the vital link of production in any emergency such as that for which we were entirely unprepared in 1914. This is not an attempt to establish chemical warfare, but to guard against its criminal use."

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GLUCOSE. "On Glucosanes." By A. Pictet and P. Castan. *Comptes rend.* July 26, pp. 243-5. "Glucosanes" are colourless and non-fermentable; obtained by the dehydration of glucose at 170°C. They have the formula $C_6H_{10}O_5$.

NITRILES. Catalytic hydration of nitriles. M. A. Mailhe. *Comptes rend.*, January 26, p. 246. An article dealing with the nitriles, especially benzonitrile.

United States

THYMOL. Synthesis of thymol from *p*-Cymene. Max Phillips and H. S. Gibbs. *J. Ind. Eng. Chem.*, August 1,733-4.

GASOLINE. Gasoline from Natural Gas. II. R. P. Anderson and C. E. Hinkley. *J. Ind. Eng. Chem.*, August, 735-738. A further article dealing with the use of charcoal in determining the gasoline content of natural gas.

COLOURS. The relative importance of some colouring matters in cane juices and syrups. F. W. Zerban. *J. Ind. Eng. Chem.*, August, 744-751. Position of tannin, iron salts and enzymes in raw cane sugar juice.

PHENOLPHTHALEIN. Behaviour of phenolphthalein with iodine, and a method for the determination of phenolphthalein. Samuel Palkin. *J. Ind. Eng. Chem.*, August, 706-769.

ARSENIC. The electrometric analysis of arsenicals. C. S. Robinson and O. B. Winter. *J. Ind. Eng. Chem.*, August, 775-778. Applications of an electrometric method of titration (i.) to the determination of trivalent arsenic, (ii.) to direct titration of pentavalent arsenic.

ACIDS. Freezing points of mixtures of sulphuric and nitric acids. W. C. Holmes. *J. Ind. Eng. Chem.*, August, 781-783. Important information to users of acids frozen during storage for nitration processes.

POTASH. Potash from Kelp. III. Kelp distillates. G. C. Spencer. *J. Ind. Eng. Chem.*, August, 786-792. Part III. of previous instalments on this subject.

CYANAMIDE. Cyanamide process plant at Muscle Shoals. C. H. Jones. *Chem. & Met. Eng.*, August 4, 182-187. A description of U.S. Nitrate Plant, No. 2.

COPPER. Elements of design of a copper refinery. L. Addicks. *Chem. & Met. Eng.*, August 4, 193-196.

GLUE. Properties and constitution of glues and gelatines, IV.-V. R. H. Bogue. *Chem. & Met. Eng.*, July 28 and August 4, 197. The last instalments of this interesting paper, including a large bibliography.

MOLYBDITE. Molybdite: Its occurrence, detection and determination in partly oxidised molybdenite ores. J. P. Bonardi. *Chem. & Met. Eng.*, August 4, 205-206.

EXPLOSIONS. Some chemical observations on the volcanic emanations and incrustations in the valley of 10,000 Smokes, Katmai, Alaska. J. W. Shipley. *Amer. J. Sci.* August, pp. 141–153. An interesting contribution on the nature of the gases evolved and the mineralisation in process in the district.

CELLULOSE. Cellulose acetate, its manufacture, uses and properties. M. Deschiens. *Chem. Age* (Amer.). July, pp. 244-248.

ALCOHOL. Recovery of alcohol from waste sulphite liquor. R. H. McKee. *Chem. Age* (Amer.), July, pp. 237-239.

RUBBER. Methods for physical testing of Vulcanised rubber goods. [A report of Committee appointed to consider this subject. Report published by Amer. Chem. Soc.] *I. R. World*, August 1, pp. 715-20.

Some notes on accelerators. H. P. Stephens. *I. R. World.* August 1, p. 720.

German

ACIDS. Arsenic-free sulphuric acid. K. Scheringa. *Pharm. Weekblad*, 1920, 57, 421–422.

ANALYSIS. Concerning the chemical analysis of wines. W. Fresenius and L. Grünhut. *Z. anal. Chem.* July. [This issue also contains much matter of interest to those who are concerned with determination of hydrocyanic acid.]

COLLOID CHEMISTRY. On the colloidal cupreous oxide. C. Paal. *Z. anal. Chem.* August, p. 146.

DYES. The group-naming of coal-tar dyestuffs. *Z. anal. Chem.* August, p. 146.

Miscellaneous

Grouping of atoms in organic chemistry. P. J. Montague. *Chem. Weekblad* (Amsterdam). July 17, 1920.

MINING. Identification of quartz particles in konimeter samples. A. W. Rogers, F.R.S. *J. Chem. Met. Soc.* of South Africa. May, 1920 (just received), pp. 228-9. A discussion of a paper printed in the journal in April.

SODIUM CARBONATE. Research for the addition of sodium carbonate to milk. A. J. Vandevelde. *Bull. Soc. Chem. Belg.*, No. 2, 1920. Showing that the addition of sodium carbonate causes a diminution of the phosphoric acid.

Oil Drilling operations in Derbyshire

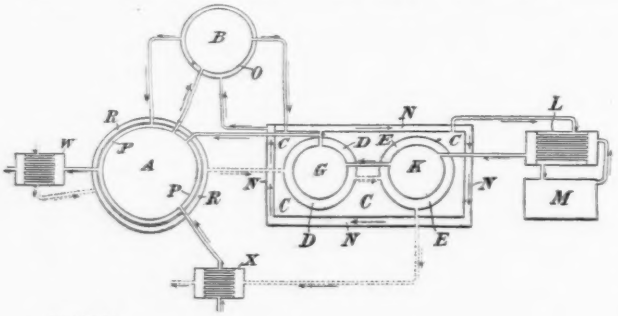
The Press Association has authority for saying that there is no truth in a statement published in the papers on Wednesday last regarding the OIL-DRILLING OPERATIONS IN DERBYSHIRE. The well at Hardstoft is continuing to yield supplies of oil, as it has done for months past without pumping, and there is no question whatever of plugging it. Drilling operations in other wells are proceeding as usual. The natural yield of the well at Hardstoft continues at the present time, as was stated by Mr. Kellaway in his speech at the Oil Exhibition at the Crystal Palace a fortnight ago, to be close upon 1 ton per day —a quantity which could be increased by pumping to 5 tons per day. The oil is of a very fine quality, and is declared by experts to be equal to the best products of the Mexican wells. The work of boring is also in progress in the selected areas of Staffordshire and Scotland, and is going on satisfactorily.

Patent Literature

Abstracts of Complete Specifications

147,235. HYDROGEN, MANUFACTURE OF. J. Harger, Grange Hollies, Gateacre, Liverpool. Application date, April 2, 1918.

Hydrogen is manufactured by alternately reducing and oxidising iron by producer gas and steam, the producer gas being enriched so that it contains 40 to 50 per cent. of nitrogen instead of the usual 60 per cent. Coal, which is rich in nitrogen and poor in sulphur, is washed, mixed with a paste of iron oxide and calcium carbonate or other sulphur retainer, and partly carbonised. The hot coke is transferred to the producer A and a mixture of air with gases obtained as described below is passed into it from the heat interchanger X. Producer gas is formed and leaves the producer at 900° to 1,200°C., and is passed through a vessel B containing briquettes of carbon, sodium carbonate and iron, which remove sulphur, &c., and absorb part of the nitrogen as sodium cyanide. The hot gas at 700° to 800°C. passes into a furnace C containing vessels D, E filled with iron ore and packed round with iron. After passing through the furnace C the gas passes through a heat interchanger L and thence to an iron oxide purifier M to remove traces of sulphuretted hydrogen. The gas then passes back through the interchanger L and into the inner vessels G, K, containing the iron ore which is thereby reduced. Heat is evolved in the vessel G, K, and if radiation losses are prevented, external heating of these vessels may be wholly or partly dispensed with. The vessels are set in a furnace N containing flues with iron chequer work into which a portion



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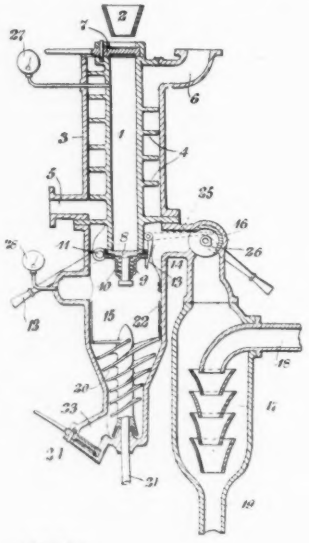
of the gas which has passed over the iron oxide is passed, mixed with air, and partly burnt. This gas is then led into a second furnace O filled with chequer brick work surrounding the vessel B, where more air is introduced and the gases burnt to supply the necessary heat for the endothermic reaction. The gas then passes into a third furnace P around the upper part of the gas generator in which the hot coke is made. Steam is circulated through the space R and is thereby superheated, and then passed into the vessels D, E containing metallic iron. The burnt gas is passed into a water heater W to generate the steam required for the process. Another portion of the partly used gas passes from the vessel G back into the generator A above the air inlet, to be reconverted into enriched producer gas. A third portion of the used gas is passed into the hottest zone of the generator A, and converted into producer gas. When the iron ore in one series of vessels D, E is reduced, the producer gas is switched on to the iron ore vessels G, K of another series. The vessels D, E are then treated with steam for the production of hydrogen which is passed into the heat interchanger X to preheat the air for the producer. The vessels D, E and G, K are thus alternately reduced and oxidised. When the sodium carbonate in the briquettes is converted into cyanide steam is passed through to convert the cyanide into ammonia and sodium carbonate. The ammonia is recovered and the briquettes are ready for use as before.

147,286. PEAT, TREATMENT OF. M. C. Olsson, 32, Bishopsgate, London. Application date, April 16, 1919.

The object is to remove the water from peat so that it may be suitable for subsequent heat treatment. Raw peat partly freed from water is fed from a funnel 2 into a cylinder 1, where it is heated by hot gases passed through the spiral conduit formed by the baffles 4. The top of the cylinder 1 may be sealed by a door 7, and the bottom by a spring controlled valve 8 which is pivoted at 11 and locked in closed position by a spring catch 13, 14. The lower end of the cylinder 1 projects into a chamber 15, which communicates through a hand operated valve 16 with a water-operated vacuum ejector 17, the discharge pipe 19 of which is 25 to 28 ft. long. When the peat is heated to 100°C. the valve 7 is closed, the valve 16 opened



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and the ejector operated to produce a vacuum of about 24 in. in the chamber 15. The valve 16 is then closed, and immediately afterwards the cam 26 lifts the lever 25 and releases the catch 13 so that the valve 8 is suddenly opened by the internal pressure in the cylinder 1 and the peat is discharged into the chamber 15. The sudden reduction in pressure frees the latent water in the peat, which was previously incapable of extraction by pressure, and renders it capable of extraction by pressure. The peat may be discharged by a helical conveyor 20.

147,311. DESTRUCTIVE DISTILLATION OF SOLID FUELS. W. Beswick and N. E. Rambush, Parkfield Works, Stockton-on-Tees. Application date, May 1, 1919.

The object is to distil solid fuel at a low temperature by passing hot gas through it. "By-product" producer gas, which is made by passing a large excess of steam into the producer with a view to the recovery of ammonia, is found to contain that proportion of steam to producer gas which gives the best result when used for the internal distillation of fuel. A larger yield of valuable by-products, especially ammonia, is thereby obtained.

147,337. ESTERS, METHODS OF FORMING. E. C. R. Marks, London. (From U.S. Industrial Alcohol Co., 27, William Street, New York.) Application date, June 23, 1919.

The process is for producing esters of the higher alcohols, *e.g.*, those contained in fusel oil, and is more particularly for producing amyl acetate. Washed fusel oil is mixed with strong sulphuric acid and glacial acetic acid and allowed to stand for 24 hours at ordinary temperature. The oily upper layer containing the amyl acetate is distilled at 100°C. to complete the esterification and remove the water, and the residue is neutralised with sodium hydroxide or carbonate, potassium hydroxide or carbonate, or milk of lime, and the sodium acetate is drawn off. The residue consists of amyl acetate. The process is also applicable to the production of butyl acetate.

147,340. CONVEYORS AND THE LIKE. J. West, Alton Lodge, Park Crescent, Southport, and West's Gas Improvement Co., Ltd., Albion Iron Works, Miles Platting, Manchester. Application date, June 26, 1919.

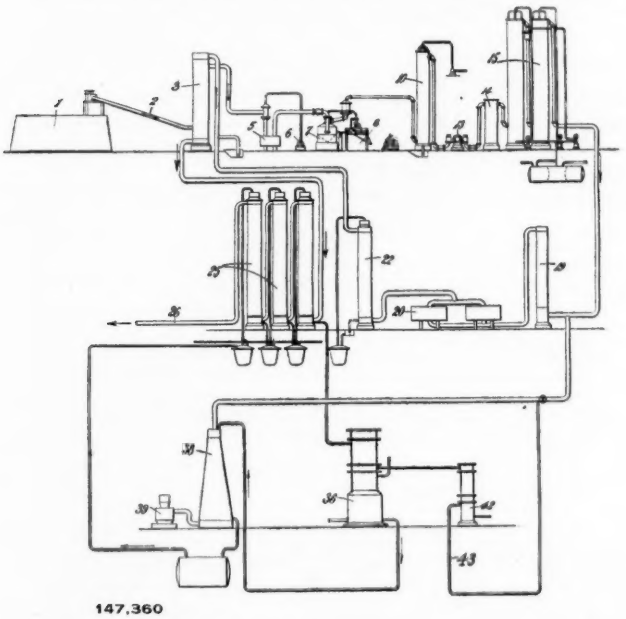
The object is to discharge a measured quantity of coke from a vertical retort into each bucket of a gravity bucket conveyor without crushing or breaking the coke. The retort discharges into a hopper having a measuring device consisting of a pivoted flat plate and curved plate. The curved plate is adapted to close the mouth of the hopper when the device is turned so as to deliver its charge into a bucket of the conveyor below, and when the curved plate is turned into open position the flat plate is horizontal to receive a measured charge. The invention consists in the provision of an opening in the side of the hopper towards which the curved plate moves when closing the outlet, so that any obstructing material is pushed out of the hopper instead of being crushed.

147,341. GRANULAR OR POWDERED MATERIAL IN MEASURED QUANTITIES, METHOD OF AND APPARATUS FOR FEEDING. The Associated Portland Cement Manufacturers (1900), Ltd., and J. G. Baxter, Park House, Gravesend. Application date, July 2, 1919.

Granular material is fed in measured quantities by maintaining a constant head and pressure over the measuring device, independently of the head of the supply. The material is fed from a hopper to a measuring conveyor through a tube containing a conveyor of greater capacity. The surplus material delivered by the larger conveyor at the point of junction of the two conveyors is continuously conveyed back to the hopper by a third conveyor.

147,360. DESTRUCTIVE DISTILLATION OF COAL, SHALE, &C., RECOVERY OF VALUABLE PRODUCTS FROM THE GASES EVOLVED IN. The Skinningrove Iron Co., Ltd., and E. Bury, Saltburn-by-the-Sea, Yorks. Application date, August 16, 1919.

The main object is to recover ethylene and its homologues from distillation gases by absorption in sulphuric acid and to convert the sulphates into their alcohols. Gas passes from the



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ovens 1 to the heat interchanger 2, tar spray 5, tar pump 6, saturator 7 and centrifugal drier 8 of the ammonium sulphate plant; thence through naphthalene scrubber 10, exhauster 13, cooler 14, benzol scrubbers 15, sulphuretted hydrogen purifier 19, oxide beds 20, sulphuric acid scrubber 22, heat interchanger 3, where it is reheated by the hot gas, and olefine scrubbers 25 to the main 26. The acid with absorbed olefines passes to a primary alcohol still 36, then to a concentrating plant 38 heated by gas from a producer 39 fired with coke breeze. The reconcentrated acid is returned to the scrubbers and the alcohol is collected at 42, the evolved sulphur dioxide passing through pipe 43 to the sulphuretted hydrogen purifier 19, where sulphur is precipitated, and is then used to make sulphuric acid for use in the olefine scrubbers and ammonia absorbers. A detailed description and particulars of results obtained are given.

147,378. NITROCELLULOSE, STABILISATION OF. B. van der Laan, Troisdorf, Germany. Application date, October 2, 1919.

Nitrocellulose is boiled with water in a wooden cylindrical boiler mounted on horizontal trunnions and provided with paddles so that the contents are agitated as the boiler is rotated. The usual caking and solidification of the nitrocellulose is thus avoided, and it may be emptied and charged into a grinding engine by means of a pump instead of by hand.

International Specifications Not yet Accepted

144,604. BORNEOL. Fabriques de Produits Chimiques de Thann et de Mulhouse, Thann, Alsace. International Convention date, June 12, 1919.

Pinene is heated with tetrachloraphthalic acid and the resulting dibornyl ester is then hydrolysed.

144,614. CATALYTIC REACTIONS, CONTROLLING. Barrett Co., 17, Battery Place, New York. (Assignees of C. R. Downs, Cliffside, N.J., U.S.A.) International Convention date, June 11, 1919.

The process is applicable to the oxidation of naphthalene to phthalic acid, anthracene to anthraquinone, benzene to maleic acid, toluene to benzoic acid and benzaldehyde, and alcohol to acetaldehyde; also to the chlorination of hydrocarbons. The heat evolved in exothermic catalytic chemical reactions is absorbed by a liquid of suitable boiling point so as to control the temperature. A number of vertical tubes closed at the bottom and partly filled with the selected cooling liquid are embedded in the catalyst and are connected at the top to a common header which may be connected to a pressure or vacuum pump so that the boiling point of the liquid may be regulated. The catalyst is heated from below by an electric heater, and the liquid in the tubes is vaporised and then condensed in their upper parts so that it runs back again. A neutral gas may be introduced into the upper parts of the tubes, *e.g.*, nitrogen when mercury is used is the cooling liquid in the oxidation of naphthalene.

144,617. TANNING AGENTS, SYNTHETIC. Rohm & Haas Co., 40, North Front Street, Philadelphia, Pa., U.S.A. (Assignees of A. Koetzle, 519, West 160th Street, New York.) International Convention date, June 6, 1919.

A product which may be used as a tanning agent is obtained by heating *m*-cresotinic acid with sulphuric acid, cooling the solution and condensing it with formaldehyde, and finally neutralising with alkali.

144,648 and 144,656. ANTHRACENE AND CARBAZOLE. Kinzlberger & Co., Prague, Czecho-Slovakia. International Convention dates, October 30, 1916, and March 31, 1917.

144,648. Crude anthracene is boiled with caustic potash and naphtha and the water formed is distilled off. The precipitated potassium carbazole is separated and converted into carbazole.

144,656. In this invention, which is a Patent of Addition to 144,648, the purification is effected below the boiling point of naphtha and the water formed is retained by using an excess of caustic potash.

144,658. DYES. Badische Anilin and Soda-Fabrik, Ludwigshafen-on-Rhine, Germany. International Convention date, April 14, 1914.

The process is for obtaining triphenylmethane dyes which give yellow shades on wool. A sulphonated aromatic aldehyde such as benzaldehyde *m*-sulphonic acid is condensed with *o*-nitraniline or a derivative having a free *p*-position such as 3-chlor-6-nitraniline. Alternatively, an unsulphonated aromatic aldehyde, such as benzaldehyde, may be substituted for the sulphonated aldehyde, and the mixture with *o*-nitraniline or the like may be subsequently sulphonated, or may be

separated into its constituents by means of hydrochloric acid before sulphonation.

144,659. AMMONIUM CHLORIDE. Badische Anilin and Soda Fabrik, Ludwigshafen-on-Rhine, Germany. International Convention date, July 10, 1915.

Ammonium chloride liquor produced in the ammonia-soda process by the use of synthetic ammonia is evaporated at 100°C. to precipitate sodium chloride and then cooled to precipitate ammonium chloride. The cold mother liquor saturated with ammonium and sodium chloride is added to a further quantity of ammonium chloride liquor, which is then treated as above.

144,663. CATALYTIC SUBSTANCES. T. Goldschmidt Akt.-Ges., Salkenbergsweg, Ruhr, Essen, Germany. International Convention date, July 25, 1918.

The properties of a solid substance used as a catalyst are modified by varying during its preparation the reaction temperature, concentration of the reagent, selection of the initial material, presence of inert material, and removal of the product. The process is applicable to metals and their oxides, carbonates, phosphates, &c. As an example, aluminium hydroxide is prepared by adding crystallised ammonium alum or aluminium sulphate to cold ammonia solution, or by treating ammonium alum with strong or dilute ammonia. The aluminium hydroxides obtained differ in properties, and the oxides obtained by ignition of the hydroxides show corresponding differences in catalytic activity.

144,677. TANNING MATERIALS. Badische Anilin and Soda-Fabrik, Ludwigshafen-on-Rhine, Germany. International Convention date, December 19, 1913.

Tanning extracts such as mangrove or quebracho are rendered easily soluble in cold water by the addition of sulphonic acids of at least tricyclic hydrocarbons, or heat condensation products of non-hydroxylated aromatic sulphonic acids. Examples of such additions are a sodium salt of a sulphonic acid of anthracene, phenanthrene, carbazol, or heat condensation products from these or from sulphonic acids of naphthalene or toluene.

144,681. AROMATIC UREAS. E. I. Du Pont de Nemours & Co., Wilmington, Del., U.S.A. (Assignees of A. P. Tanberg and H. Winkel, Wilmington, Del., U.S.A.) International Convention date, September 11, 1918.

Methylaniline or other secondary aromatic amine is mixed with benzene, xylene, solvent naphtha, carbon tetrachloride or other inert solvent, and treated with phosgene at 70°C. to produce tetra-substituted ureas.

144,710. ELECTRIC ENDOSMOSE. Elektro-Osmose Akt.-Ges. (Graf. Schwerin Ges.), 35, Lindenstrasse, Berlin. International Convention date, April 8, 1918.

The process is for the electro-osmotic separation of mixtures of colloids, ions, and non-ionised substances. Ions such as chloride, sulphate, or phosphate which are unsuitable for the process are replaced by inorganic or organic ions of the same or different valency, and calcium, magnesium, or aluminium are replaced by ammonium, sodium, or potassium. As an example, a mixture of ammonium, sulphate and albumen is treated with barium acetate and the barium sulphate removed. The mixture may then be treated in a 3-compartment cell. When electrolysed with a positive diaphragm at the anode, the mixture remains slightly alkaline, and albumen is not precipitated.

144,712. COAL AND SHALE DISTILLING. Prince Karl of Lowenstein, 57, Bambergerstrasse, Berlin, A. Irinyi, 54, Mittelweg, Hamburg, and T. Kayser, 21A, Potsdamerstrasse, Berlin. International Convention date, October 28, 1918.

Coal or shale is distilled at a low temperature in a horizontal retort by means of steam or hot air which passes through a hollow conveyor screw in the retort and also through a jacket surrounding the retort. The conveyor blade is cleaned by an endless band of scrapers.

144,727. GLYCERINE, DECOLORISING. Elektro-Osmose Akt.-Ges. (Graf. Schwerin Ges.), 35, Lindenstrasse, Berlin. International Convention date, February 12, 1919.

A solution containing glycerine and sulphuric acid is treated with powdered oxalic acid in excess to decolorise the glycerine, and then with barium carbonate to recover the glycerine.

144,728. LEAD-ZINC ORES, EXTRACTING METALS FROM. F. Krupp Akt.-Ges. Grusonwerk, Buckau, Magdeburg, Germany. International Convention date, June 3, 1919.

Finely divided lead-zinc ore is mixed with powdered sodium chloride or its solution and heated to the temperature at which sodium chloride volatilises. Lead and silver are also volatilised and may be collected. The process may be applied to concentrates, furnace dust, &c., and to the extraction of metals such as copper, bismuth, and molybdenum.

LATEST NOTIFICATIONS.

149,318. Manufacture of Alkali Cellulose. L. Lilienfeld. August 1, 1919.

149,320. Manufacture of the Carbohydrates $n(C_6H_{10}O_5)$, their conversion products and derivatives. L. Lilienfeld. August 6, 1919.

148,763. Process for obtaining sulpho-acids from brown coal-tar oils. Sudfeldt & Co. March 14, 1919.

148,779. Recovery of nitrogen compounds from coal-peat or bituminous shale. Riedel, A. November 8, 1915.

148,780. Manufacture of compounds of nitrogen. A. Riedel. November 20, 1915.

148,782. Recovery of ammonium chloride from fuel. A. Riedel. February 29, 1916.

148,783. Recovery of Nitrogen contained in the fuel during combustion. A. Riedel. February 29, 1916.

148,784. Recovery and fixation of Nitrogen contained in fuel. A. Riedel. July 16, 1917.

148,802. Apparatus for separating solid substances from gases and vapours, more especially blast furnace gases. Deutsche Maschinen-fabrik Akt.-Ges. December 2, 1918.

148,885. Process for preparing Nitrogen or nitrogen and hydrogen mixtures. L. Casale. July 12, 1919.

148,892. Process and apparatus for converting hydrocarbons into fatty acids. Deutsche Erdol Akt.-Ges. July 12, 1919.

148,923. Process for the production of nitro-compounds of tetrahydronapthalene and its derivatives, as well as reduction products of these nitro bodies. Tetralin Ges. March 17, 1916.

149,008. Process and apparatus for utilising impure gases or exhaust gases containing carbonic acid. A. Riedel. November 24, 1917.

149,297. Purification of zinc-bearing solutions. R. T. D. Williams, R. T. Gepp, and K. P. Webb. July 17, 1919.

149,303. Manufacture of zinc oxide. H. E. L. Fievet. July 17, 1919.

149,304. Process of absorbing nitrous vapours. Soc. Anon. L'Azote Francais. July 18, 1919.

Specifications Accepted, with Date of Application

117,070. Tubular evaporating, condensing, and cooling apparatus. E. Barbet et Fils et Cie. June 21, 1917. Addition to 114,838.

123,739. Furnace retorts. C. H. Smith. February 18, 1918.

125,083. Peat Fuel, Process for manufacturing. H. P. K. T. Nielsen. March 30, 1918.

148,588. Cooling and liquefaction of gaseous fluids, Process and apparatus for. O. Imray. (*E. A. W. Jefferies.*) January 30, 1919.

148,615. Basic sulphate of chrome, Production of—and its application to tanning and other uses. J. Morel. April 22, 1919.

148,617. Dyes, Manufacture of. R. Maclaurin. April 24, 1919.

148,630. Muffle and semi-muffle and like furnaces. C. F. Priest. April 26, 1919.

148,637. Grinding or disintergating ores or other materials, Method of. H. W. Hardinge. April 29, 1919.

Applications for Patents

Aktiebolaget Karlstads Mekaniska Verkstad. Rollers for rolling-out water from wood-pulp, cellulose, &c. 23,326. August 9. (Sweden, August 16, 1919.)

Alby United Carbide Factories. Production of calcium carbide. 23,425. August 10.

Anderson, W. and Meikle, J. Process of treating mineral tars other than coal tar. 23,569. August 12.

Barrett Co. Production of resins from naphthas. 23,454. August 10. (United States, August 28, 1919.)

Canadian-American Finance & Trading Co. & Stephens, A. L. Process for volatilising and decomposing hydrocarbons. 23,357. August 9.

" Process for treating hydrocarbons. 23,646. August 12.

" Process for saturating unsaturated compounds. 23,647. August 12.

Carpmael, W. (*Farbenfabriken vorm. F. Bayer & Co.*) Manufacture of soluble chromium lakes of azo-dyes. 23,551. August 11.

Davis, R. H. Vaporisers for liquid gases. 23,517. August 11.

Farbenfabriken vorm. F. Bayer & Co. Soluble chromium lakes of azo-dyes. 23,551. August 11.

Fabwerke vorm. Meister, Lucius, & Bruning. Manufacture of methane. 23,446. August 10. (Germany, April 15.)

Firth, A. Treatment of soya beans for recovery of oil and production of synthetic milk. 23,815. August 14.

Fischer, F. Production of resinous bodies from phenols and oxygen. 23,422. August 10. (Germany, May 24, 1919.)

Heinemann, K. and Hoesch & Co. Process for recovery of pure caustic alkalis from impure lyes. 23,818. August 14.

Keillor, F. B. Combination plant for manufacture of coal gas, blue-water gas, and coal tar or oil-gas. 23,700. August 13.

Mitchley, J. W. Production of calcium carbide. 23,425. August 10.

Schroeter, G. Hydrogenation of naphthalene. 23,530. August 11.

Tretalin Ges. Hydrogenation of naphthalene. 23,530. August 11.

Industrial Conditions in Germany.

FROM the "L. Angew Chem.," June 22, July 2, 1920, we learn that the main business of the majority of factories since the war has been export trade, but it has been checked by a falling off in demands from abroad as well as on the home market. The absence of raw materials and fuel are the main factors which are depressing the industries of the country, and although some improvement is shown in certain branches, leading to more employment and higher wages, the outlook generally is still uncertain. In the drug industry wages have risen, but fuel shortage is causing considerable trouble. The conditions in the colour trade are not satisfactory. Though still in a leading position, the aniline dye industry is suffering from lack of fuel, and one important firm was unable to carry out more than 40 per cent. of its orders. Many firms which were manufacturing powder and explosives are now lying idle or converting their plant for the purpose of peace work. With regard to the tar-distillation industry, one important firm reports having failed to obtain more than 60 per cent. of the raw materials required; many other works are closing down for longer or shorter periods. The wood-distillation industry is also experiencing great difficulties owing to the short supply of raw materials which were formerly imported from foreign countries, such as Poland, Austria, Hungary, &c. More favourable reports are forthcoming from manufacturers of photographic goods, oils and artificial fertilisers. Speaking generally, the industries of the country have suffered severely from the shortage of coal and raw materials, and, if matters do not improve, more workmen will be dismissed. Wages can neither be lowered nor can they be raised further, and, as factories are still working up their costly raw material, the prices of goods cannot at present be reduced.

The reorganisation of the German potash industry on the basis of self-administration is now complete, and although no tangible improvement due to the activity of the various potash offices is as yet apparent, the liberation of the industry from the guardianship of the States bureaus will soon be felt, and prices can now be fixed in accordance with the increase in wages and cost of material.

During 1919 potash prices had to be raised three times in order to cover costs, and the industry became dependent upon foreign trade for its profits. A large number of works had to be closed down owing to lack of coal, and those that kept running either required little coal—viz., those producing kainite, manure salts and chlorate of potash, or owned their own supply (Kaliwerke Aschersleben). Output has been kept back by a number of factors, such as the bad condition of the plants, shortage of materials, industrial unrest, &c.

The net profit for 1919 of the Kaliwerke Aschersleben was 17,661,511 mk. (2,317,667 mk. in 1918), the increase being due to the exports of chlorate and sulphate that began in the latter half of the year. The pre-war dividend of 10 per cent. (7 per cent. in 1918) was reverted to, and a bonus given of 200 mk. per share. It was decided to issue 2,500,000 mk. of 6 per cent. preference shares, thus raising the capital to 25 million mk.

Small Scale Manufacture of Barium Chlorate

AMONG the chemicals used in the manufacture of military pyrotechnics, barium chlorate occupies a prominent position. Since examination shows that the only methods for the preparation of barium chlorate are through (1) the metathesis of barium chlorate with sodium chlorate, (2) the chlorination of barium carbonate, and, especially (3) "the electrolysis of barium chloride," which is said to be the method by which "the barium chlorate of commerce is invariably prepared," it seems proper to place on record an account of a recent emergency use of the method known as Wheeler's method by the Ordnance Department, U.S.A. It appears that during 1917 a Navy Department laboratory was unable to obtain any bids for supplying barium chlorate for use in its green signal rockets and flares. Up to this time this material had been imported from Germany at a very reasonable price. Attempts were made to substitute compositions made from various copper salts and potassium chlorate, with sugar, flour and other combustible substances, but the brilliancy of the green light obtained with barium chlorate mixtures apparently could not be duplicated. This condition of affairs was brought to the notice of the pyrotechnic schools of the department, and it was arranged that they should make up to 500 lb. in the laboratory, while the department arranged another permanent source of supply. The method is very interesting.

A survey of the materials immediately available having shown a sufficient supply of sodium chlorate, hydrofluosilic acid and barium carbonate at hand, it was determined to proceed by Wheeler's method as shown in the following expressions:—

$$2NaClO_3 + H_2SiF_6 = 2HClO_3 + Na_2SiF_6$$
$$2HClO_3 + BaCO_3 = Ba(ClO_3)_2 + H_2O + CO_2$$

All the substances employed were commercial. The determined amount of sodium chlorate was dissolved in the least quantity of hot water possible, this was then added to a known quantity of the hydrofluosilicic acid in a stoneware jar and allowed to stand until the sodium fluosilicate formed had settled; the chloric acid was then decanted to another stoneware jar, the sodium fluosilicate stirred up with hot water allowed to settle and the weak acid decanted and added to that in the other jar. The chloric acid was then neutralised with barium carbonate, concentrated in galvanised washtubs and allowed to crystallise; the mother liquid was saved and then sevefal portions batched together would be evaporated to dryness, and this impure chlorate used in place of part of the sodium chlorate to prepare the chloric acid. The barium chlorate was crystallised a second time, dried on a fruit evaporator, ground to better than 80 mesh in a coffee burr mill and sacked. Something over 400 lb. was made and proved to be satisfactory. The work was discontinued when the United States Navy Department was able to interest other parties in manufacturing this material electrolytically.

Theoretically, 1 part of sodium chlorate yields about 1½ parts of barium chlorate; by this method we obtained a yield of but 1 to 1, the chief loss being due to the difficulty in separating the chloric acid from the sodium fluosilicate. It is also of interest that the production of barium salts in the United States, other than the natural barium compounds, was so new at that time that this small production was taken into account by the Geological Survey in its 1917 report.

Some of the crystal groups obtained in the course of this work were quite attractive. One of them, in fact, was presented to the National Museum and deemed by its curator worthy of a place in its exhibits.

Alsatian Potash

THE demand for Alsatian potash during the past six months has quite exceeded expectations. Despite great transport difficulties on the Rhine and delays occasioned by strikes at Rotterdam and Antwerp supplies have been made available on shortest notice. Considering these handicaps, together with the reorganisation required after the war, it is surprising that the Alsatian potash industry has developed so rapidly.

The following prices are quoted for the past week: Sylvinite (French kainite), 14-16 per cent., £7 15s.; sylvinite (French manure salts), 20 per cent., £9 15s.; muriate of potash, 50 per cent., £28 5s., per ton f.o.r. in bags.

Monthly Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, *and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co. and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The weekly report contains only commodities whose values are at the time of particular interest or of a fluctuating nature. A more complete report and list are published once a month. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.*

Market Report

WEDNESDAY, AUGUST 18.

There has been a very quiet tendency during the past week which is only to be expected at the height of the holiday season, but the general impression is that a revival in demand may be expected towards the end of this month.

The steady tone of the second-hand market, together with the firm attitude of manufacturers, seems to indicate that few lower prices may be expected for some time to come.

There is little change to report in the export trade, which is still rather patchy.

General Chemicals

ACETONE is in quiet demand and unchanged in price.

ACID ACETIC is still in restricted demand, but the price is fully maintained. Stocks are steadily diminishing.

ACID CARBOLIC remains a weak and uninteresting market.

ACID CITRIC is unsteady, and further concessions in price are obtainable from several holders.

ACID FORMIC is in quiet demand and unchanged in value.

ACID LACTIC.—Little business is passing and price nominally unchanged.

ACID OXALIC is in fair demand and is perhaps slightly firmer in tendency.

ARSENIC is particularly scarce and spot supplies are now at a premium.

BARIUM SALTS are featureless.

COPPER SULPHATE.—Business remains practically dead. Price nominally unchanged.

FORMALDEHYDE.—A limited quantity has been sold at rather below the recent figure, but supplies are still scarce and are firmly held.

LEAD SALTS are in very poor demand, but unchanged in price.

POTASSIUM BICHROMATE.—Only nominal business is passing The price is rather easier.

POTASSIUM PERMANGANATE is quiet and inclined to be easier in price.

SODIUM ACETATE is unchanged in price, and only a very small business is reported.

SODIUM BICHROMATE.—Easier market owing to the absence of export business, but as the supplies available are very nominal, an improvement in the export demand would quickly react upon the general position.

SODIUM CAUSTIC maintains the improvement indicated last week, and resale parcels are decidedly fewer.

SODIUM HYPOSULPHITE remains a nominal market, as supplies are practically unobtainable.

SODIUM NITRITE is firmer in price and arrivals are light.

SODIUM SULPHIDE is a little lower in price, but this is again largely due to the smaller export demand.

ZINC SALTS are quiet and without change.

Coal Tar Intermediates

This market has been rather featureless, and there are no alterations of note to report.

ANILINE OIL AND SALT have been a quiet market without change in price.

ALPHANAPHTHYLAMINE has been nominally without change, with only a small business passing.

BETANAPHTHOL is firm and quiet, and a fair business has been reported.

DIMETHYANLINE is practically unobtainable and the price is quit nominal.

NITRO BENZOLE has been in fair request and the price is very firm.

NAPHTHIONIC ACID is steady with a moderate business passing.

PARANITRANILINE is without change in price and a fair business has been transacted at fair figures.

XYLIDINE is wanted on export account.

Coal Tar Products

There is very little change in the market for Coal Tar Products since last week.

90's BENZOL is a little firmer and is quoted at 3s. 4d. on rails in the North and 3s. 6d. in London. Supplies are still very scarce.

PURE BENZOL is worth 3s. 7d. to 3s. 10d. per gallon on rails.

CREOSOTE OIL remains firm at 1s. to 1s. 1d. in the North and 1s. 1d. to 1s. 2d. in the South.

CRESYLIC ACID is still slow, and is quoted at 4s. to 4s. 2d. per gallon for the Dark 95/97 per cent. quality, and 4s. 6d. to 4s. 9d. per gallon for the Pale 97/99 per cent. quality.

SOLVENT NAPHTHA 90/160 is worth about 3s. 5d. per gallon.

HEAVY NAPHTHA 90/190 is now worth 3s. 7d. per gallon.

NAPHTHALENE.—The demand for this article in both Crude and Refined forms is still increasing. The price is still £16 to £20 for the Crude, and £50 to £52 per ton for the Refined.

PITCH.—The position remains unchanged.

Sulphate of Ammonia

Business in this material is still quiet, but prices are maintained.

Current Prices

Chemicals

	per	£	s	d.		£	s.	d.
Acetic anhydride	lb.	0	3	9	to	0	4	0
Acetone oil	ton	90	0	0	to	95	0	0
Acetone, pure	ton	120	0	0	to	125	0	0
Acid, Acetic, glacial, 99-100%	ton	105	0	0	to	110	0	0
Acetic, 80% pure	ton	87	10	0	to	90	0	0
Arsenic	ton	100	0	0	to	105	0	0
Boric, cryst.	ton	74	10	0	to	76	0	0
Carbolic, cryst. 39-40%	lb.	0	1	1½	to	0	1	2
Citric	lb.	0	4	9	to	0	5	0
Fluoric	lb.	0	0	7½	to	0	0	8
Formic, 80%	ton	115	0	0	to	120	0	0
Gallic, pure	lb.		8	3	to	0	8	6
Hydrofluoric	lb.	0	0	7½	to	0	0	8
Lactic, 50 vol.	ton	58	0	0	to	60	0	0
Lactic, 60 vol.	ton	72	10	0	to	75	0	0
Nitric, 80 Tw.	ton	41	0	0	to	44	0	0
Oxalic	lb.	0	2	6	to	0	2	7
Phosphoric, 1.5	ton	65	0	0	to	67	0	0
Pyrogallic, cryst	lb.	0	11	6	to	0	11	9
Salicylic, Technical	lb.	0	2	6	to	0	2	8
Salicylic, B.P.	lb.	0	3	3	to	0	3	6
Sulphuric, 92-93%	ton	8	10	0	to	8	15	0
Tannic, commercial	lb.	0	3	0	to	0	3	3
Tartaric	lb.	0	3	3	to	0	3	4
Alum, lump	ton	19	10	0	to	20	0	0
Alum, chrome	ton	93	0	0	to	95	0	0
Alumino ferric	ton	9	0	0	to	9	10	0
Aluminium, sulphate, 14-15%	ton	17	10	0	to	18	10	0
Aluminium, sulphate, 17-18%	ton	20	10	0	to	21	10	0
Ammonia, anhydrous	lb.	0	2	2	to	0	2	4
Ammonia, .880	ton	45	0	0	to	50	0	0
Ammonia, .920	ton	32	10	0	to	37	10	0
Ammonia, carbonate	lb.	0	0	7½	to		—	
Ammonia, chloride	ton	100	0	0	to	105	0	0
Ammonia, muriate (galvanisers)	ton	60	0	0	to	65	0	0
Ammonia, nitrate	ton	65	0	0	to	70	0	0
Ammonia, phosphate	ton	125	0	0	to	130	0	0
Ammonia, sulphocyanide	lb.	0	3	0	to	0	3	3
Amyl acetate	ton	410	0	0	to	420	0	0
Arsenic, white, powdered	ton	74	0	0	to	76	0	0
Barium, carbonate, 92-94%	ton	12	10	0	to	13	0	0
Barium, chlorate	lb.	0	0	11	to	0	1	0
Chloride	ton	32	0	0	to	33	0	0
Nitrate	ton	55	0	0	to	56	0	0

	per	£	s.	d.		£	s.	d.
Barium Sulphate, blanc fixe, dry...	ton	28	10	0	to	30	0	0
Sulphate, blanc fixe, pulp ...	ton	16	10	0	to	17	0	0
Sulphocyanide, 95%	lb.	0	1	6	to	0	1	8
Bleaching powder, 35-37%	ton	26	0	0	to	28	0	0
Borax crystals	ton	41	0	0	to	42	10	0
Calcium acetate, Brown.....	ton	20	0	0	to	21	0	0
,, Grey.....	ton	35	0	0	to	37	10	0
Calcium Carbide	ton	30	0	0	to	32	0	0
Chloride.....	ton	9	10	0	to	10	10	0
Carbon bisulphide.....	ton	65	0	0	to	67	0	0
Casein, technical	ton	75	0	0	to	80	0	0
Cerium oxalate.....	lb.	0	3	9	to	0	4	0
Chromium acetate	lb.	0	1	2	to	0	1	4
Cobalt acetate	lb.	0	8	6	to	0	9	0
Oxide, black	lb.	0	10	0	to	0	10	3
Copper chloride	lb.	0	1	3	to	0	1	6
Sulphate	ton	41	0	0	to	42	0	0
Cream Tartar, 98-100%	ton	215	0	0	to	225	0	0
Epsom salts (*see* Magnesium sulphate)								
Formaldehyde 40% vol.....	ton	325	0	0	to	320	0	0
Formusol (Rongalite)	lb.	0	5	0	to	0	5	6
Glauber salts	ton	Nominal.						
Glycerine, crude.....	ton	70	0	0	to	72	10	0
Hydrogen peroxide, 12 vols.	gal.	0	2	8	to	0	2	9
Iron perchloride	ton	50	0	0	to	52	0	0
Iron sulphate (Copperas)	ton	4	0	0	to	4	5	0
Lead acetate, white	ton	85	0	0	to	87	10	0
Carbonate (White Lead).....	ton	65	0	0	to	67	10	0
Nitrate.....	ton	72	0	0	to	75	0	0
Litharge	ton	59	0	0	to	61	0	0
Lithopone, 30%	ton	50	0	0	to	51	0	0
Magnesium chloride.....	ton	15	10	0	to	16	10	0
Carbonate, light.....	cwt	2	15	0	to	3	0	0
Sulphate (Epsom salts commercial)	ton	13	10	0	to	14	0	0
Sulphate (Druggists')	ton	18	10	0	to	19	10	0
Manganese, Borate.....	ton	190	0	0	to		—	
Sulphate	ton	100	0	0	to	105	0	0
Methyl acetone.....	ton	95	0	0	to	100	0	0
Alcohol, 1% acetone	gall.	Nominal.						
Nickel ammonium sulphate, single salt	ton	60	0	0	to	62	0	0
Nickel ammonium sulphate, double salt.....	ton	62	0	0	to	64	0	0
Potassium bichromate	lb.	0	2	1	to	0	2	2
Potassium Carbonate, 90%	ton	115	0	0	to	120	0	0
Chloride.....	ton	50	0	0	to	52	0	0
Chlorate	lb.	0	0	9½	to	0	0	10½
Meta-bisulphite, 50-52%	ton	260	0	0	to	270	0	0
Nitrate, refined	ton	65	0	0	to	67	0	0
Permanganate	lb.	0	4	0	to	0	4	3
Prussiate, red	lb.	0	5	3	to	0	5	6
Prussiate, yellow.....	lb.	0	2	0	to	0	2	1
Sulphate, 90%	ton	31	0	0	to	33	0	0
Salammoniac, firsts	cwt.	5	10	0	to		—	
Seconds	cwt.	5	5	0	to		—	
Sodium acetate	ton	59	0	0	to	61	0	0
Arsenate, 45%	ton	60	0	0	to	62	0	0
Bicarbonate	ton	10	10	0	to	11	0	0
Bichromate	lb.	0	1	7	to	0	1	8
Bisulphite, 60-62%	ton	50	0	0	to	52	10	0
Chlorate	lb.	0	0	5½	to		—	
Caustic, 70%	ton	36	10	0	to	38	0	0
Caustic, 76%	ton	39	10	0	to	41	0	0
Hydrosulphite, powder, 85%	lb.	0	4	0	to	0	4	6
Hyposulphite, commercial.....	ton	35	10	0	to	37	10	0
Nitrite, 96-98%.....	ton	87	10	0	to	90	0	0
Phosphate, crystal.....	ton	44	0	0	to	46	0	0
Perborate.....	lb.	0	2	2	to	0	2	4
Prussiate	lb.	0	1	2½	to	0	1	3½
Sulphide, crystals	ton	30	0	0	to	32	0	0
Sulphide, solid, 60-62%	ton	62	10	0	to	64	0	0
Sulphite, cryst.....	ton	15	10	0	to	16	10	0
Strontium carbonate	ton	85	0	0	to	90	0	0
Nitrate.....	ton	90	0	0	to	95	0	0
Sulphate, white	ton	8	10	0	to	10	0	0
Sulphur chloride.....	ton	42	0	0	to	44	10	0
Sulphur, Flowers	ton	19	0	0	to	19	10	0
Roll	ton	19	0	0	to	19	10	0
Tartar emetic	lb.	0	3	2	to	0	3	4
Tin perchloride, 33%	lb.	0	2	6	to	0	2	7
Perchloride, solid	lb.	0	3	0	to	0	3	3
Protochloride (tin crystals)....	lb	0	2	0	to	0	2	1
Zinc chloride, 102 Tw.	ton	22	0	0	to	23	10	0
Chloride, solid, 96-98%.....	ton	60	0	0	to	65	0	0
Oxide, 99%.....	ton	82	10	0	to	85	0	0
Oxide, 94-95%	ton	70	0	0	to	72	10	0
Dust, 90%	ton	90	0	0	to	92	10	0
Sulphate	ton	21	10	0	to	23	10	0

Coal Tar Intermediates, &c.

	per	£	s.	d.		£	s.	d.
Alphanaphthol, crude	lb.	0	4	0	to	0	4	3
Alphanaphthol, refined	lb.	0	5	6	to	0	5	9
Alphanaphthylamine.....	lb.	0	4	0	to	0	4	3
Aniline oil, drums extra	lb.	0	1	8	to	0	1	9
Aniline salts	lb.	0	1	10	to	0	2	0
Anthracene, 85-90%	lb.		—		to		—	
Benzaldehyde (free of chlorine).....	lb.	0	5	9	to	0	6	0
Benzidine, base	lb.	0	13	6	to	0	14	0
Benzidine, sulphate	lb.	0	10	6	to	0	11	0
Benzoic acid	lb.	0	5	3	to	0	5	6
Benzoate of soda	lb.	0	5	3	to	0	5	6
Benzyl chloride, technical	lb.	0	2	0	to	0	2	3
Betanaphthol benzoate.....	lb.	1	6	0	to	1	7	6
Betanaphthol	lb.	0	5	6	to	0	5	9
Betanaphthylamine, technical.....	lb.	0	11	6	to	0	12	6
Croceine Acid, 100% basis	lb	0	5	0	to	0	6	3
Dichlorbenzol	lb.	0	0	6	to	0	0	7
Diethylaniline.....	lb.	0	7	9	to	0	8	6
Dinitrobenzol	lb.	0	1	4	to	0	1	5
Dinitrochlorbenzol	lb.	0	1	5	to	0	1	6
Dinitronaphthaline	lb.	0	1	6	to	0	1	8
Dinitrotoluol.....	lb.	0	1	8	to	0	1	9
Dinitrophenol.....	lb.	0	2	9	to	0	3	0
Dimethylaniline	lb.	0	5	3	to	0	5	9
Diphenylamine.....	lb.	0	5	0	to	0	5	3
H-Acid.....	lb.	0	14	6	to	0	15	0
Metaphenylenediamine	lb.	0	5	9	to	0	6	0
Monochlorbenzol	lb.	0	0	10	to	0	1	0
Metanilic Acid	lb.	0	7	6	to	0	8	6
Monosulphonic Acid (2:7).....	lb.	0	7	6	to	0	8	0
Naphthionic acid, crude	lb.	0	5	6	to	0	6	0
Naphthionate of Soda.....	lb.	0	6	0	to	0	6	3
Naphthylamin-di-sulphonic-acid...	lb.	0	5	6	to	0	6	6
Nitronaphthaline	lb.	0	1	4	to	0	1	6
Nitrotoluol	lb.	0	1	3	to	0	1	4
Orthoamidophenol, base.....	lb.	0	18	0	to	1	0	0
Orthodichlorbenzol	lb.	0	1	1	to	0	1	2
Orthotoluidine.....	lb.	0	2	6	to	0	2	9
Orthonitrotoluol.....	lb.	0	1	3	to	0	1	4
Para-amidophenol, base	lb.	0	15	0	to	0	16	0
Para-amidophenol, hydrochlor	lb	0	15	6	to	0	16	6
Paradichlorbenzol	lb.	0	0	6	to	0	0	8
Paranitraniline	lb.	0	8	6	to	0	9	0
Paranitrophenol	lb.	0	2	9	to	0	3	0
Paranitrotoluol.....	lb.	0	5	9	to	0	6	0
Paraphenylenediamine, distilled ...	lb.	0	13	6	to	0	14	6
Paratoluidine.....	lb.	0	8	6	to	0	9	6
Phthalic anhydride.....	lb.	0	4	9	to	0	5	0
R. Salt, 100% basis.....	lb.	0	4	0	to	0	4	2
Resorcin, technical	lb.	0	11	6	to	0	12	6
Resorcin, pure	lb.	1	2	6	to	1	3	0
Salol.....	lb.	0	6	9	to	0	7	6
Shaeffer acid, 100% basis.....	lb.	0	3	6	to	0	3	0
Sulphanilic acid, crude	lb.	0	1	6	to	0	1	7
Tolidine, base	lb.	0	10	6	to	0	11	6
Tolidine, mixture	lb.	0	3	0	to	0	3	6

Liverpool Chemical Trade

Messrs. WATHALL & Co., Liverpool, report that the chemical market has been quietly steady during the past fortnight. Caustic soda has continued to decline through lack of demand, but there is again more inquiry, and there being very little in second hands a little buying would probably cause an advance. Bleaching powder has been in rather better request for export, and a feature is that there is some demand from Canada and the U.S.A., which is rather surprising in view of the cheap offers that were made from America a few months ago. Bichromates are very quiet, and the better demand has fallen away. Caustic and carbonate of potash are offered rather more freely, but very little interest is displayed by buyers. Cream of tartar is lower. Coaltar products generally are quite firm. Sulphate of ammonia is without change at the regular official quotations. Nitrate of soda is steady, with no further change to report. In sulphate of copper there was a slight demand a week ago, but it has fallen away again, and quotations are unchanged, although manufacturers report that second-hand sellers are accepting below cost; the shipments for July were very small, being but 671 tons against 1,911 a year ago and 1,747 two years ago, and the total for October-July at 22,825 tons are 20,050 tons below the total for the same period a year ago, and 26,135 tons below October-July two years ago. Saltcake for export has been in better request, and most of the cheap second-hand parcels appear to have been absorbed.

Glasgow Gas Works' By-Products

Erection of New Plant

ATTENTION is being given in Glasgow to the development of the by-product industry in connection with the Corporation gas works. According to the statement by Mr. W. A. Walmsley, who is in charge of the chemical side of the gas department's activities, it is the intention of the department in future to treat all their by-products themselves, and extensive plant is being erected at Provan for that purpose.

The principal chemical products of course are ammonia liquor and tar. The former is either made into sulphate of ammonia for agricultural purposes or pure liquid ammonia, and in the future the department may make it into other products or sell it as pure ammonia. The tar has to go through a process of distillation and to be split up into crude benzol, light oil, carbolic oil, creosote and pitch, which is the residuum left at the finish of the distillation of the tar. These processes are to be carried on at Tradeston, Dawsholm, Dalmarnock and Provan, and the crude oils are then to be transferred to Provan works for refining purposes. There it is expected to make from them motor spirit, pure benzol, toluol, solvent and heavy naphthas, and various acids will also be extracted, while special tars for road-making purposes, creosote mixtures for fuel purposes, special creosotes for fuel purposes and for use in Diesel engines will also be manufactured. It is an entirely new development for the department, which had hitherto confined its attention to crude distillation at Dalmarnock, where the products only represented about one-eighth of the total for the city. Including the Dalmarnock works, the revenue last year from tar and ammoniacal liquor was £306,577, and a conservative estimate places the net revenue from these sources for the current year at over £400,000. In this respect it is interesting to observe, from the accounts of the department, that, despite the higher prices received from the contractors, the return per ton of coal carbonised was higher at Dalmarnock than elsewhere, the respective figures per ton being: Dalmarnock, 8s. 9d.; Dawsholm, 6s. 9d.; Tradeston, 7s. 1d.; and Provan, 8s. 3d., and in the last-mentioned case the figure was subject to a rebate of 10d. for acid allowance. It is expected that when the Provan plant is in full operation—which will probably be early next year—there will be a steady augmentation of revenue.

Company News

UNITED LIMMER & VORWOHLE ROCK ASPHALTE.—The balance sheet for the six years ended December 31, 1919, shows that the small yearly profit made in Sicily has been more than absorbed by the losses in Germany and the general charges of the company. The profit and loss account for the period shows a total loss of £14,102. The losses ceased in 1918, and 1919 shows a small profit which would have been much larger had the German business begun to be profitable during that year. For 1920 prospects both in Germany and Sicily are said to be encouraging.

DACIA ROMANO PETROLEUM.—The first report of the Dacia Romano Petroleum Syndicate states that the directors have decided that March 31 is the most convenient date for closing the financial year, so that as the company was incorporated on February 11, 1919, the present report covers a period slightly in excess of a full year. The net profit for the period was £1,172, against which the directors recommend that the formation expenses, £938, be written off, and that the balance of £234 be carried forward.

BITING RUBBER ESTATES, LTD.—At a meeting in London on Wednesday it was reported that oil had been discovered on the property, and that a concession had been applied for and the ground staked.

Books Received

A HANDBOOK OF PHYSICS AND CHEMISTRY. By Herbert E. Corbin and Archibald M. Stewart. 5th edition. London: J. & A. Churchill. Pp. 496. 15s. net.

REPORT ON THE ECONOMIC, FINANCIAL AND INDUSTRIAL CONDITIONS OF HOLLAND FOR THE YEAR 1919. By R. V. Laming. London: H.M. Stationery Office. Pp. 114. 1s. net.

Lysle Distributing Agencies

Official Receiver's Report

UNDER the compulsory winding-up order made against the Lysle Distributing Agencies, Ltd., manufacturers and merchants of toilet and chemical preparations, 9, Gamage Buildings, High Holborn, W.C., Mr. E. T. A. Phillips, assistant Official Receiver, has issued a summary of the company's statement of affairs, together with a report on the failure. The statement shows gross liabilities £3,631 17s. 8d. and a deficiency of £2,956 15s. 11d. As regards shareholders there is an additional deficit of £5,000, making a total deficiency of £7,956 15s. 11

The assistant Official Receiver states that the company was registered as a private company on August 14, 1919, and was formed, *inter alia*, to carry on business as manufacturers and merchants of or agents for toilet and other chemical or medicinal preparations. According to Mr. John de Lysle, a director, the business was started early in 1919 by the brothers Sidney and Joseph Wolff, who possessed certain formulæ prepared by Dr. Wolff for the manufacture of toilet and other preparations. The principal business of the company was the manufacture of Dr. Wolff's preparations known as "Nicodine," "Pyro Dandruff Destroyer," and "Pyrotone Tooth Paste." The formulæ for these preparations had not been handed to the Official Receiver and were not included in the statement of affairs, though they formed part of the property acquired by the company. On December 1, 1919, Mr. de Lysle promoted a company called the Lysle Export & Import Co., Ltd., to carry on a business similar to that of the company, and in April, 1920, still another called Lylco., Ltd., with practically the same objects. Mr. de Lysle had previously undertaken not to be interested in any business similar to that carried on by the company, and the question as to his liability for any damage suffered by the company by reason of the promotion of the other companies were matters for further consideration. The explanation furnished by Mr. de Lysle was that it was agreed that he should not be bound by the undertaking referred to, and that the export company was formed by him for the purpose of purchasing materials to be supplied to the company on credit. There was, however, no evidence to support this contention, adds the Official Receiver.

The company had agencies at Croydon, Glasgow and Sheffield The failure of the company was attributed by de Lysle to the incompetence and mismanagement of the brothers Wolff in the running of the factory. He also stated that large quantities of manufactured goods were purchased which it had never been intended that the company should trade in, and that these goods were afterwards sold for considerably under cost price. This, however, was denied by the brothers Wolff.

The Official Receiver is acting as liquidator.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

LOCALITY OF FIRM OR AGENT.	MATERIALS.	REF. NO.
British West Indies	Soap	187
Buenos Aires .	Chemicals; lubricating oils; paints; varnishes	203
Toronto ...	Drugs	172
Paris	Chemical products...	232
Winnipeg ...	Lubricating oils; greases... ...	211
Smyrna ...	Chemicals	240
Egypt ...	Oils; chemicals	226

Oils Wanted for Dublin

A Dublin firm inquires from firms able to supply oils suitable for making soap, such as cotton seed oil, linseed oil, fish oil, &c. Particulars may be obtained from THE CHEMICAL AGE.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

London Gazette

Partnership Dissolved

MANNING, THOMAS BRAMAH, MANNING, JAMES, MANNING, JOHN, and MANNING, HARRY, glass blowers, 24, Cranmer Road, Brixton, S.W., under the style of J. M. & S., by mutual consent as from April 27, 1920. All debts received and paid by James Manning, John Manning and Harry Manning, who will carry on the business under the style of James Manning & Sons.

Notices of Intended Dividends

LAWS, JOHN JOSEPH, 14, Greyhound Lane, Streatham Common, Surrey, chemist and druggist. 8½d. Supplemental August 30. Official Receiver's Offices, 132, York Road, Westminster Bridge Road, S.E.1.

VILLAIN, PAUL MAURICE, 14, Effra Road, Brixton, Surrey, carrying on the business of analytical chemist. September 4. Trustee, Walter Boyle; Bankruptcy Buildings, Carey Street, London.

Deed of Assignment

WOOLDRIDGE, THOMAS, 26, Lisle Street, Leicester Square, London, chemist and druggist. Creditors who have not already sent in their claims are requested, or on before September 10, to send in their names and addresses, with full particulars of their debts or claims, to 32, Kimberley House, Holborn Viaduct, London. Parkin Stanley Booth Trustee.

Liquidators' Notice

WESTERN COUNTIES & GENERAL MANURE CO., LTD. (In voluntary liquidation).—A meeting of the creditors of the above company will be held at 10, Princess Square, Plymouth, on Saturday, August 28, 1920, at noon. Eric R. Ward, Solicitor for the Liquidators, 10, Princess Square, Plymouth.

County Court Judgments

[*NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.*]

LUNN, H. NILSON, Croft's Pharmacy, Victoria Street, Grimsby, chemist, £10 18s. 10d. July 14.

BROWN, W. H., 82, Uplands Road, Hornsey, manufacturing chemist, £13 18s. 4d. July 9.

BROWN, EDGAR NORMAN, 78, Margaret Grove, Harborne, oil and colour merchant, £17 3s. July 13.

JAMES, H. P., Tudor Square, Tenby, chemist, £12 1s. 5d. July 9.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, created after July 1, 1908, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges which would, if created after July 1, 1908, require registration. The following Mortgages and Charges have been so registered. In each case the total debt, as specified, in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced since such date.*]

BRITISH VEGETABLE OIL EXTRACTION CORPORATION, LTD., London, E.C.—Registered August 6, £250,000 debenture stock, secured by Trust Deed dated July 26, 1920; charged on Angel Oil Mills, Edmonton, also general charge. *£216,250. June 10, 1920.

C.V.O. CHEMICAL WORKS (1919), LTD., London, S.W.—Registered August 3, £7,000 mortgage, to D. Watney & Son, Ltd., The Brewery, High Street, Putney; charged on land and buildings, now or lately known as The Brewhouse, Richmond.

FISHBROOK DYEING CO., LTD., Kearsley.—Registered August 5, £4,500 debenture, to G. Chadwick, Clayton Dyeworks, Manchester; general charge. *£1,500. November 17, 1919.

OXLEY'S (J. C.) DYES & CHEMICALS, LTD. (formerly Oxley & Hird, Ltd.), Dewsbury.—Registered August 14 (by order on terms), £300 mortgage, to Halifax Equitable Benefit Building Society, Halifax; charged on land at Heckmondwike. *——. January 14, 1920.

New Companies Registered

The following have been prepared for us by Jordan & Sons, Ltd., company registration agents, 116 and 117, Chancery Lane, London, W.C. :—

AMALGAMATED OILFIELDS OF TRINIDAD, LTD., 13, Copthall Court, E.C.2.—Petroleum or other oils. Nominal capital, £250,000 in 250,000 shares of £1 each. Minimum subscription, 7 shares. Directors: W. B. Mitford, R. S. Bagnall, T. H. Beare, C. C. Cragg. Qualification of directors, £100. Remuneration of directors, £200 each; chairman, £300.

BOW BRIDGE DYES & CHEMICAL WORKS, LTD., 46, Gresham Street, E.C.2.—Chemists and druggists. Nominal capital, £100 in 100 ordinary shares of £1 each. Minimum subscription, 7 shares. Directors: A. E. V. Sadd, A. S. Roynton. Qualification of directors, £10. Remuneration of directors, £250 (to be divided).

BOYD & DOWER, LTD., 101, St. Mary's Road, Garston, Liverpool.—Drysalters, druggists, chemists and oil and colourmen. Nominal capital, £1,000 in 1,000 shares of £1 each. Directors: J. H. Boyd, T. Dower. Qualification of directors, £25.

BUSH, BEACH & GENT, LTD.—Chemical and dye merchants. Nominal capital, £10,000 in 10,000 shares of £1 each. Directors: S. G. C. Mason, F. H. Beach, K. C. Lindsay. Qualification of directors, 50 ordinary shares.

CORNWALL ARSENIC CO., LTD., Redruth, Cornwall.—Dealers in ores of arsenic, sulphur. Nominal capital, £10,000 in 10,000 ordinary shares of £1 each. Directors: Sir G. J. Smith, G. H. I. Beckford, W. R. Mitchell, F. D. Bain, and two others. Qualification of directors, £250.

NORTH-WESTERN COLOUR CO., LTD., 2, South King Street, Manchester.—Colour and dye merchants. Nominal capital, £5,000 in 4,000 ordinary shares and 1,000 preference shares of £1 each. Directors: W. R. Dykes, R. E. Dykes.

RECORD OIL & GREASE CO. (1920), LTD.—Manufacturers, distillers and refiners of mineral, animal and vegetable oils. Nominal capital, £5,000 in 5,000 shares of £1 each. Directors: J. Davidson, A. B. Mallinson. Qualification of directors, 1 share.

WAVERLEY WORKS, LTD.—Bleachers and dyers. Nominal capital, £25,000 in 25,000 shares of £1 each. Directors: W. R. Dunham, A. G. Day, F. W. Dunham, W. F. Day. Qualification of directors, 100 shares.

JOHN F. CARMICHAEL & Co., Ltd., Tower Building, LIVERPOOL

Telegrams: "Gaylussac, Liverpool." Chemical Engineers and Contractors. Telephone: 5265 Central.

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Essential Oil Dept.: Manager, Mr. W. V. Guenigault, 33 St. Mary-at-Hill, E.C.

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GALLIC ACID
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GLYCERINE
GLYCEROPHOSPHATES
GUAIACOL ABSOLUTE
GUAIACOL CARBONATE
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HETRALINE
HEXAMINE
HYDROKINONE
HYPOPHOSPHITES
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IODIDES
IODOFORM
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LYSOL
LYSOLINE
MAGNESIUM
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METHYL SALICYLATE
METHYL SULPHONAL
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OTTO OF ROSE
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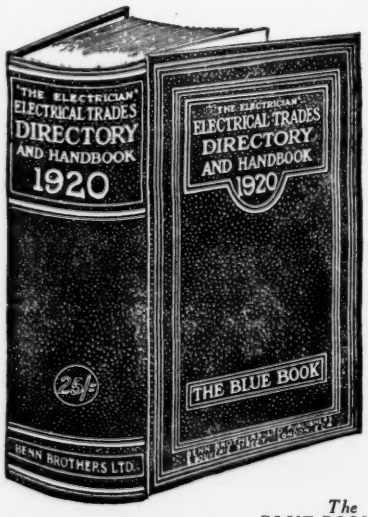

The BLUE BOOK